IDAHO BIRD INVENTORY and SURVEY (IBIS)
A plan to implement Coordinated Bird Monitoring in Idaho

July 2004
Version 1.0

Prepared for the Idaho All-Bird Working Group by:

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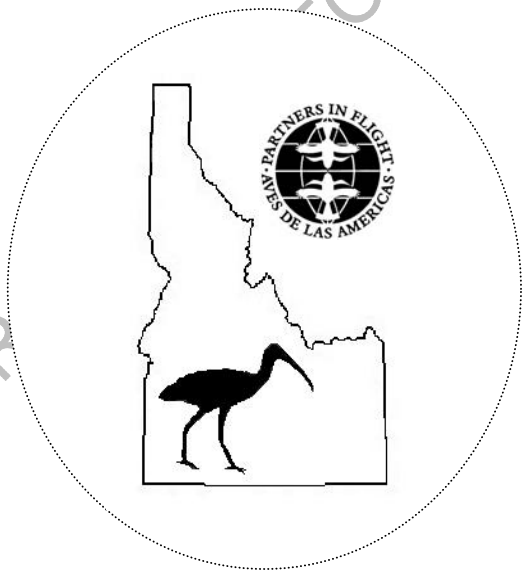

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Endorsements

The undersigned endorse the Idaho Bird Inventory and Survey (IBIS) plan and agree to participate in it. Specifically:

1. A representative from each agency or organization listed below will attend the annual meeting to review past work and plan future IBIS projects.

2. The organizations will take reasonable and prudent steps to insure that the program is implemented and remains viable in the long-term and that bird surveys conducted by the partners are coordinated, working through the IBIS steering committee.

3. The undersigned will function as an advisory board that oversees the general direction and goals of the IBIS program in the long-term.

Idaho Department of Fish and Game	Idaho Audubon Council
U.S. Dept. of Interior – Geological Survey	Ducks Unlimited
U.S. Dept. of Interior – Bureau of Land Management	Potlatch Corporation
U.S. Dept. of Interior – Fish and Wildlife Service	Boise Corporation
U.S. Dept. of Agriculture – Forest Service	Teton Regional Land Trust
Nez Perce Tribe	The Nature Conservancy of Idaho
Intermountain West Joint Venture	Idaho Bird Observatory

Acknowledgments

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Executive Summary

Conservation and management of Idaho's birds depends on adequate monitoring information, which, to a large extent, does not currently exist. Even more basic information on distribution and abundance is poorly understood for many bird species. Monitoring information is required by legislative and land/wildlife management agency mandates as well as a host of forest plans, ecoregional plans, preserve management plans, and state comprehensive wildlife conservation strategies. A statewide all-bird monitoring program was one of the highest priority needs identified in the Idaho Partners in Flight Bird Conservation Plan. It is important to monitor bird populations not only because their conservation is important in its own right, with a high level of legal, scientific, and public concern, but also because birds are useful indicators of environmental health. Birds are one of the best tools for monitoring the effects of current land-use practices; they are the most easily detected and identified vertebrates, simple survey methods can cover many species, and accounting for and maintaining many species with different requirements promotes conservation strategies at the landscape scale.

To meet these monitoring needs, the Idaho Bird Inventory and Survey (IBIS)[1] has been developed to help managers decide which of 306 bird species that regularly occur in Idaho warrant management action due to declines; to identify causes of such declines; and to help managers plan and evaluate land-use practices, conservation, and restoration. In addition, IBIS is designed to address specific habitat-related conservation concerns for birds of Idaho: (1) inventory needs of Idaho Department of Fish and Game Wildlife Management Areas for birds in all seasons (indefinite number of species); (2) effects of human activities on wetlands and the birds that depend on them (119 species); (3) conflicts between piscivorous birds and fish populations (5 species); (4) effects of human activities on riparian areas (141 species); (5) condition of aspen habitat and its importance to birds (34 species); (6) identification of high quality habitat and effects of land-use practices in sagebrush communities (54 species); (7) impacts of forest thinning (including salvage logging) and fuels reductions projects, particularly in Ponderosa Pine habitats (31 species); and (8) effects of management in Pinyon-juniper habitats (48 species). Identifying species at risk and causes of their declines is a permanent need, whereas habitat-specific management issues can be addressed with relatively short-term (e.g., 3–5 year) studies, followed by other short-term priorities as identified. To identify species at risk, population trend information is needed. Habitat-specific management issues can best be addressed by describing spatial patterns in abundance, identifying habitat relationships, followed by studying productivity to determine quality of available habitats in relation to reference sites or other suitable standards. This plan provides quantitative objectives for addressing each of the management issues, identifies the best methods for collecting the needed information, provides estimated sample size requirements, identifies responsibilities for implementation, and makes recommendations on project management and the next steps toward implementation.

[1] Recommended citation: Moulton, C., R. Sallabanks, E. Ammon, and J. Bart. 2004. Idaho Bird Inventory and Survey (IBIS): A plan to implement coordinated bird monitoring in Idaho. Version 1.0. Idaho Department of Fish and Game, Boise, ID. 236 pp.

Introduction

The Idaho Bird Inventory and Survey (IBIS) is a plan to monitor all birds in Idaho that most wildlife- and land-management agencies would contribute to and benefit from. Importantly, IBIS is designed to be part of a new program called "Coordinated Bird Monitoring" (CBM) that is currently being developed at the national level (http://amap.wr.usgs.gov). CBM is a joint effort by managers and bird monitoring specialists to improve the success of bird monitoring programs, and make the information available to all partners. Its approach focuses on: (1) providing information on specific land-management issues from reliable monitoring data; (2) describing focal species and quantitative survey objectives for each management issue; (3) choosing survey methods and estimating needed sample sizes; (4) storing all data in permanent, widely available data repositories; (5) analyzing data using methods endorsed by the appropriate professional societies; and (6) using effective methods for communicating results to decision-makers. This all-bird coordination effort is modeled after a long-standing program, implemented by the Flyway Councils, of continent-wide tracking of waterfowl to set management and harvest strategies for game species (e.g., www.pacificflyway.gov). As with the waterfowl model, coordinated all-bird monitoring is intended as a feedback system that can provide a scientific basis for management and conservation planning for birds of management concern.

Coordinated Bird Monitoring plans are being developed at the state, regional, and continental levels. Each plan describes existing monitoring programs, and then identifies needed improvements and new programs using the following approach (Fig. 1):

(1) Identify large-scale management issues that the program helps address (goals);
(2) Identify information that is needed (objectives);
(3) Select the methods that will be used (strategies); and
(4) Identify the parties that have primary responsibility for implementing each program component (implementation plan).

Several projects are already in progress, at the continental level, that will help implement monitoring recommendations at the state, province, or regional level. For example, a system for conducting peer reviews of survey protocols is currently being developed, data repositories are being constructed, and rapid habitat survey methods are being designed. IBIS is designed to use these resources and to support the continental programs, where appropriate.

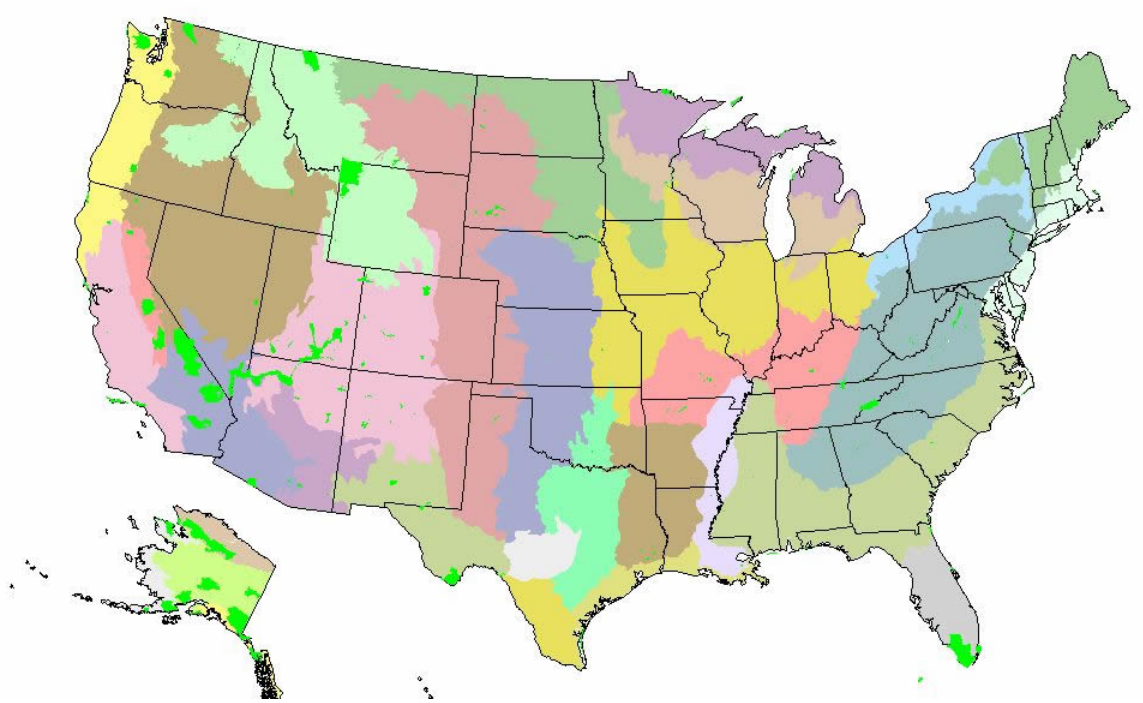
Bird Conservation and Management Regions

In 1998, the North American Bird Conservation Initiative (NABCI) was formed as an international forum for coordination of conservation efforts of existing major bird initiatives (i.e., landbirds, waterfowl, waterbirds, shorebirds). One goal of NABCI is to increase the effectiveness of, and coordination between, existing and new bird conservation programs. As a recommended framework for coordinated bird management, NABCI adopted and mapped ecological units called Bird Conservation Regions (BCRs; Fig. 2). BCRs are ecologically distinct regions with similar bird communities, habitats, and resource management issues. Technically speaking, Idaho is covered by three BCRs (Great Basin BCR-9; Northern Rockies, BCR-10; and Southern Rockies/Colorado Plateau, BCR-16). The Great Basin BCR covers most of southern Idaho, the Northern Rockies BCR covers north-central Idaho and the Idaho Panhandle, and a small sliver of the Southern Rockies/Colorado Plateau BCR enters southeastern Idaho.

Although BCRs provide an ecologically meaningful framework for studying bird populations, designing surveys at such a large scale has limitations. For example, in contrast to surveys in upland habitats, which can be designed at large spatial scales, surveys of wetland habitats require detailed local-level

Figure 1. Steps in developing Coordinated Bird Monitoring plans.

Figure 2. Bird Conservation Regions of the United States.



information to ensure sufficient assessment of aquatic species. Therefore, CBM collaborators formed smaller Bird Monitoring Regions (BMRs), by intersecting the BCR map with a Province and State map, deleting small polygons, and smoothing the borders (Fig. 3). The resulting BMRs allow for individual states to more feasibly develop detailed assessments of bird populations within their designated regions. Idaho consists of two BMRs, BMR-50 and BMR-51 (Fig. 3), which will be used to organize IBIS. However, because they are a functional subset of BCRs and state/provincial boundaries, these BMRs can easily be scaled up to BCR or state levels to assess larger scale monitoring issues, as needed. In Idaho, BMR-50 and BMR-51 roughly correspond with the portions of BCR-10 and BCR-9/BCR-16, respectively, that cover the state.

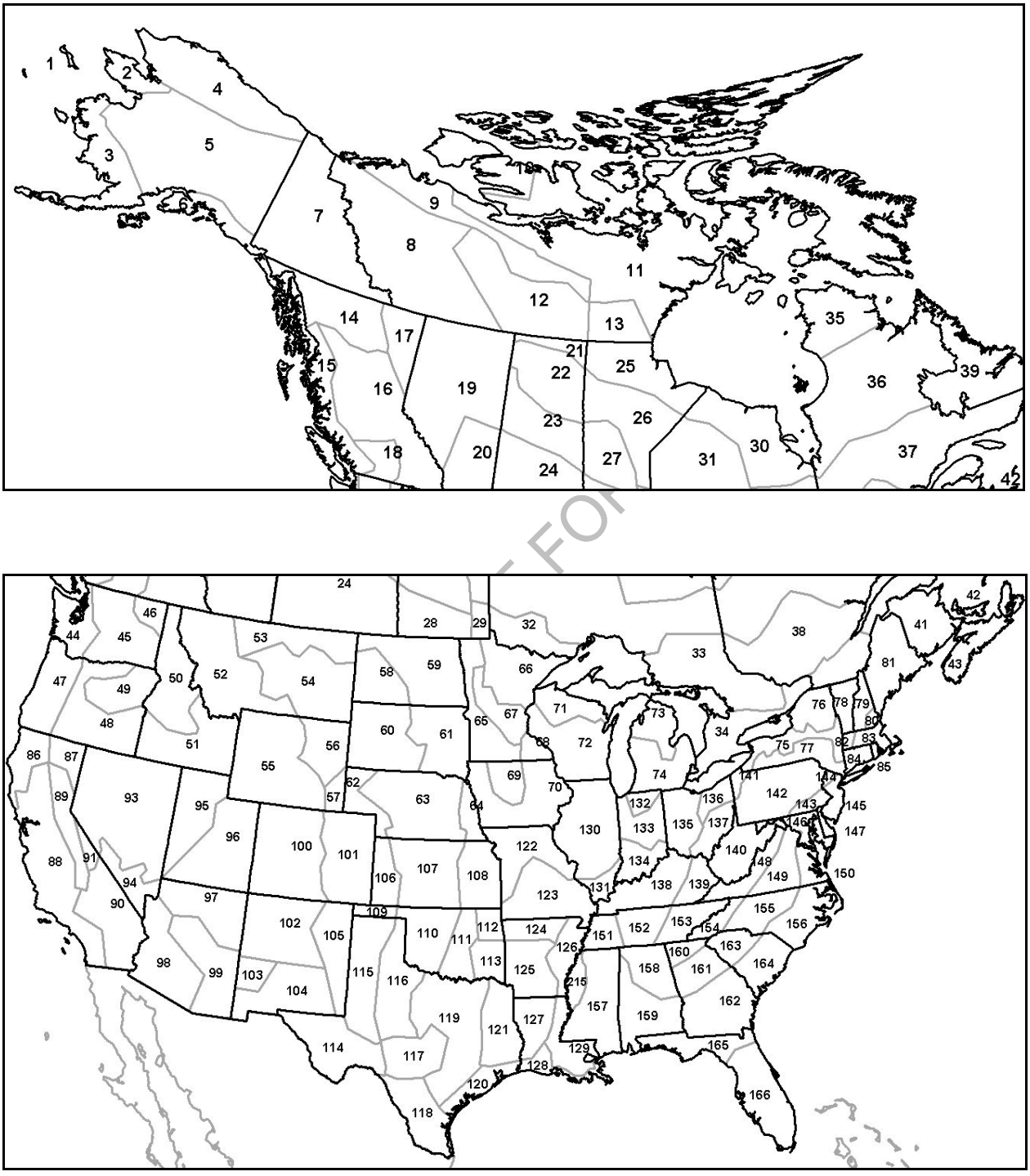
Why is IBIS needed?

Conservation and management of Idaho's birds depends on adequate monitoring information, which, to a large extent, does not currently exist. Even more basic information on distribution and abundance is poorly understood for many bird species. Monitoring information is required by legislative and land/wildlife management agency mandates as well as a host of forest plans, ecoregional plans, preserve management plans, and state comprehensive wildlife conservation strategies. A statewide all-bird monitoring program was one of the highest priority needs identified in the Idaho Partners in Flight (IdPIF) Bird Conservation Plan (BCP) (version 1.0; Idaho Partners in Flight 2000: http://www.blm.gov/wildlife/plan/pl_id_10.pdf). It is important to monitor bird populations not only because their conservation is important in its own right, with a high level of legal, scientific, and public concern, but also because birds are useful indicators of environmental health. Birds are one of the best tools for monitoring the effects of current land-use practices; they are the most easily detected and identified vertebrates, simple survey methods can cover many species, and accounting for and maintaining many species with different requirements promotes conservation strategies at the landscape scale.

Because activities outside the jurisdiction of a given agency may cause declines in the organisms that reside therein, even if local activities may not be affecting organisms negatively, long-term trend monitoring is essential. Populations also may be declining due to interactions among multiple management effects, which could not be predicted based on single-effect studies. The only way to expose such problems is through long-term monitoring of actual population trends. Long-term monitoring of population trends is useful for discovering if populations are in decline, but by itself is not very useful for discovering the reason behind such declines. Nor is it useful for finding out if specific management practices are affecting populations or causing declines. More targeted population monitoring, designed to address specific management issues, is therefore a very significant component of IBIS.

Throughout the state, some bird monitoring programs are already in place, such as the Breeding Bird Survey (BBS). Unfortunately, there are several reasons why the BBS alone is not sufficient to attain all of Idaho's monitoring goals: (1) land managers need monitoring data that are more regional than national in scope, and the resolution of the BBS is too coarse for regional decision-making; (2) BBS routes are roadside counts that have many inherent biases; (3) the BBS does not collect habitat information with sample locations, nor does it use a point-count protocol that is conducive to studying habitat relationships; and (4) BBS, inherently, does not provide information on migrating and wintering bird populations. Of the 244 bird species that are known to breed in Idaho, approximately 60% are not adequately monitored by the BBS. At least 60 additional bird species, which regularly occur in Idaho only during migration and winter, are not monitored by BBS. Of the species that are well monitored by the BBS, there are some whose populations are declining, some that are increasing, and some that are stable. Presumably, better data will detect more species in each of these categories, which is of great concern because there are probably many declines that currently remain undetected.

Figure 3. Bird Monitoring Regions in Canada (upper pane) and the United States (lower pane).



Summary of Existing Bird Monitoring and Assessment Projects in Idaho

Breeding Bird Survey (BBS)
There are currently 58 BBS routes in Idaho, the majority of which (60%) are surveyed on a regular basis. BBS routes are 25 miles long, are located along roads, and consist of three-minute unlimited-distance (technically, only birds within ¼ mile of route observers are recorded) point counts at each of 50 stops (for more details see http://www.pwrc.usgs.gov/birds). It is anticipated that BBS coverage in Idaho will increase in future years under the IBIS framework.

Christmas Bird Counts (CBC)
There are currently 38 CBC count circles in Idaho, 60% of which are surveyed annually. CBC count circles are 15 miles in diameter, in which bird counts take place over a 24-hour period between December 14th and January 5th (for more details, see http://www.audubon.org/bird/cbc).

Northern Region Landbird Monitoring Program (NRLMP)
The NRLMP (http://biology.dbs.umt.edu/landbird/landbird.htm), which is a collaborative effort between the U.S. Forest Service (USFS), other agencies (e.g., Bureau of Land Management [BLM]) and private organizations (e.g., Potlatch Corporation), consists of alternating yearly point counts (1) along 300 permanently-marked transects and (2) in targeted land-use practice areas, within the USFS Northern Region (northern Idaho and western Montana). Permanent transects, which were placed in a geographically stratified random fashion in 1994, are located along USFS roads and trails and consist of 10 equally-spaced point-count stations. Counts are conducted for 10 minutes at each station during one visit in the breeding season. Vegetation data are collected at each point-count station to allow for analysis of habitat associations and effects of different forest management practices. During alternate years, point count efforts are focused on addressing effects of particular land-use practices, such as prescribed fire, timber harvesting, and grazing.

Songbird Migration Monitoring
Monitoring of fall songbird migration occurs at one mist-net station in Idaho. This mist-net station is operated by Idaho Bird Observatory (IBO; http://www.idbsu.edu/biology/ibo/index.html) at Lucky Peak (since 1997) in the Boise Foothills. Banding operations at Lucky Peak are standardized, allowing for the use of yearly capture rates of individual species for long-term migration monitoring.

Monitoring Avian Productivity and Survivorship (MAPS)
There are three MAPS stations, which monitor breeding bird populations through mist-netting efforts, in Idaho. These include one station operated by Idaho Bird Observatory (IBO; Lucky Peak: since 2000) in southwestern Idaho, one station operated by the Idaho Department of Fish and Game (IDFG; Vassar Meadows: since 1997), and one station operated collaboratively by IDFG and BLM (Salmon/Pattee Creek: since 1998). Two additional MAPS stations are being started in the Panhandle by IDFG in 2004. Ideally, the number of MAPS stations in Idaho will increase in future years as both funding and demand for MAPS data increase.

Waterfowl
Idaho Department of Fish and Game, in collaboration with other agencies (e.g., U.S. Fish and Wildlife Service [USFWS]), conducts, on average, five standard fixed-wing aerial surveys of the major

waterbodies in Idaho each year. In the second week of January (since the 1950s), a flight is conducted statewide to survey wintering waterfowl. In February, wintering Trumpeter Swans (scientific names in Appendix A unless noted in text) are surveyed in eastern Idaho, in conjunction with surveys of Montana and Wyoming. These surveys include Rocky Mountain Population swans from both the tri-state area (Idaho, Montana, Wyoming) and Canada. The results of this survey are compared with a Trumpeter Swan Productivity survey flight conducted in September, to determine what proportion of wintering swans are from the Canadian population. Also in September, a flight is conducted to survey Sandhill Crane populations of eastern Idaho. A fifth flight is conducted in April for a statewide survey of Canada Goose pairs.

Duck brood surveys are conducted on IDFG Wildlife Management Areas (WMAs) irregularly throughout the state, although nest surveys of Trumpeter Swans are conducted annually. Ground surveys of Trumpeter Swans also are conducted in combination with the fall and winter aerial surveys to count birds in isolated habitats not covered by aerial survey. Duck banding takes place on various National Wildlife Refuges and state-owned lands during the breeding season each year (approx. 2000 birds banded per year). In addition, waterfowl and Sandhill Cranes are monitored by IDFG through a post-season questionnaire that is mailed to approximately 5% of the licensed hunters of a given season. Summary questions included in the request are: which species were hunted, how many (of each species) were harvested, and in which hunting unit did hunting occur. Follow-up phone calls are made to all hunters who did not respond to the mailing. Finally, as part of the nationwide federal parts survey efforts (USFWS), wings of harvested waterfowl are mailed in by hunters to USFWS for assessment at the Pacific Flyway level.

Streams in northern and north-central Idaho are surveyed for Harlequin Ducks on an annual basis. Streams where harlequins are known to occur are generally given priority over new streams that haven't previously been surveyed. Surveys are conducted primarily by walking in and along streams, and also by rafting or inner tubing and driving on roads adjacent to streams. The harlequin is listed as a Species of Special Concern by IDFG and is classified as a Level II priority species by IdPIF. The purpose of monitoring this important species is therefore to maintain information on population status and continue to document distribution. Additional surveys along new streams within the known range of the harlequin are anticipated to be part of IBIS.

Upland Gamebirds

Greater Sage-Grouse and Sharp-tailed Grouse leks are inventoried annually by IDFG using aerial and ground surveys. These surveys are used to search for new lek locations. In addition, ground crews are deployed to conduct lek counts at known lek locations. The main measure of interest is number of males attending the lek. This information is used in management planning and harvest management. IDFG also collects wings from harvested sage-grouse and Sharp-tailed Grouse by placing wing barrels in areas of local hunter congregation (campgrounds, etc.). Wings are used to estimate demographic parameters of the hunted populations, such as sex and age ratios.

Other upland game birds present in Idaho include Wild Turkey, Blue Grouse, Ruffed Grouse, Spruce Grouse, Grey Partridge, Ring-necked Pheasant, Chukar, Northern Bobwhite, Gambel's Quail, Mountain Quail, California Quail, and Mourning Dove. Spruce Grouse, Blue Grouse, Ruffed Grouse, Mountain Quail (not hunted since 1984), and Mourning Dove are considered native to all or most of their current range in Idaho, while the others have been introduced for hunting through much or all of the their range. IDFG collects wings harvested from Ruffed Grouse, Spruce Grouse, Blue Grouse, California Quail, Grey Partridge, and Chukar. Similar to Sage Grouse and Sharp-tailed Grouse, wings are used to estimate demographic parameters of hunted populations. All upland game birds are monitored by IDFG through a post-season questionnaire that is mailed to approximately 5% of the licensed hunters of a given season. Summary questions included in the request are: which species were hunted, how many (of each species) were harvested, and in which hunting unit did hunting occur. Follow-up phone calls are made to all

hunters who did not respond to the mailing. Targeted harvest questionnaires also are sent to those hunting Ring-necked Pheasant on WMA lands, and those hunting Wild Turkey (both spring and fall surveys). Depending on the region, IDFG also conducts population trend monitoring of Ring-necked Pheasant (brood counts and spring crowing counts), Grey Partridge (brood counts), California Quail (brood counts), and Chukar (late-summer/early fall helicopter surveys).

Mountain Quail have recently been surveyed statewide and early results suggest that birds are still present in areas considered by most to be traditional strongholds (e.g., Riggins to Pollock along the Little Salmon River); isolated sightings of birds in other regions suggest that any remaining populations are relatively disjunct. Spring surveys in 2003–2004 were the first attempts in approximately 10 years to document Mountain Quail locations. These surveys will likely continue more frequently in future years, especially as plans are discussed to reintroduce quail to historic sites where habitat appears most suitable.

Raptor Monitoring

Because Idaho boasts an impressive raptor community, particularly along the Snake River floodplain of southern Idaho, multiple monitoring efforts for breeding, migrating, and wintering raptors currently exist. During the breeding season, Bald Eagles, Golden Eagles, Peregrine Falcons, Prairie Falcons, American Kestrels, Northern Goshawks, Ferruginous Hawks, and Burrowing Owls are monitored by various agencies (IDFG, USGS, BLM), non-profit organizations (IBO), universities (Boise State University), and private organizations/individuals (e.g., Potlatch, Merlin Systems, Idaho Power Company). Goshawk productivity has been tracked for more than a decade in both eastern (Caribou-Targhee National Forest) and south-central (Sawtooth National Forest) Idaho. In the fall, raptor migration is monitored annually by IBO at Boise Peak (since 1993) and Lucky Peak (since 1995), where they use a combination of surveys (Lucky Peak only) and raptor banding. Hawkwatch surveys at Lucky Peak are standardized to allow for year-to-year comparisons, with the long-term goal of being able to detect a 50% change in numbers of a given species over a 20-year period. In addition, IBO (Lucky Peak) conducts standardized annual monitoring (since 1999) of the migration of small forest owls, targeting Flammulated and Saw-whet Owls. Finally, wintering populations of Bald Eagles are monitored as part of a national survey effort that includes over 70 survey routes, at least 60 of which are surveyed annually (since 1980), coordinated by USGS, BLM, IDFG, USFS, Idaho Power Company, and the Environmental Science & Research Foundation.

Bald Eagle territory occupancy and nest productivity are monitored annually by IDFG and other agency partners throughout the state. All known territories are checked at least three times during the breeding season and data are submitted for annual reporting requirements. Annual trends show steadily increasing eagle populations with approximately 150 pairs nesting statewide in 2003. Bald Eagle monitoring will continue as normal in future years, even after delisting, which is anticipated to occur during the latter part of 2004. Peregrine Falcons are monitored in a similar way, primarily by IDFG nongame biologists; all known eyries are checked for occupancy and subsequent evidence of breeding success on an annual basis. Surveys are conducted for previously undiscovered territories in areas of suitable habitat when time allows. Idaho's peregrine monitoring is supported by IDFG, BLM, and USFS on an annual basis. Although recently delisted, monitoring of all known peregrine territories will continue annually, with numbers now on the order of 25 pairs statewide.

U.S. Forest Service Management Indicator Species

Roadside transects have recently been established by the USFS to allow for monitoring of two Management Indicator Species (MIS), the White-headed and Pileated Woodpeckers. Surveys began in 2003–2004 for most survey routes and will continue indefinitely. Other forest birds (e.g., owls, songbirds) could be surveyed along the same transects at different times of the year and/or day. Involvement by the USFS as IBIS v2.0 (terrestrial species) is developed will ensure coordinated monitoring of all birds, both on and off public lands across the state. In southern Idaho (USFS Region 4),

collaborative efforts to add surveys on USFS lands are currently being discussed, pilot work on forest owls is being conducted, and songbird monitoring to complement the NRLMP (described above) is under consideration.

Other bird monitoring and surveying projects that have been completed, are in progress, or are proposed include:

- IBO is currently conducting a statewide shrubsteppe study to identify habitat relationships of obligate shrubsteppe bird species. Although not a long-term monitoring project, when completed it will provide a network of approximately 100 sites spread across most major shrubsteppe areas in Idaho. IBO intends to use these sites in the future for studies of demographics and long-term monitoring of both shrubsteppe birds and habitat.
- BLM intends to begin monitoring Yellow-billed Cuckoos along the Snake River Area of Critical Environmental Concern in spring 2004, as the status of this species is a growing concern in the western U.S.; surveys also were conducted throughout eastern Idaho in 2003 to update distribution information for this high priority species.
- Red Willow Research is conducting a survey of bird species in pinyon-juniper habitats of southeastern Idaho. This two-year (2003–2004) study involves spring and summer point counts within pinyon-juniper stands and associated riparian areas. The Idaho Conservation Data Center (IdCDC) also has proposed to study pinyon-juniper habitats of southern Idaho, beginning in 2004. Although the primary focus will be measuring habitat variables, avian surveys also are an integral part of this project.

Important Bird Areas (IBA) Program

Idaho's IBA Program was launched in 1996 as a partnership between IdPIF and the Idaho Audubon Council. An IBA Technical Committee was formed to encourage nominations and review materials for candidate IBAs. From 1997 through 2000, the committee reviewed nominations and voted to accept, reject, or table each nomination. To date, 53 sites have been identified as IBAs in Idaho (http://www.audubon.org/bird/iba/id.html). The Idaho IBA program is now beginning phase two of the IBA process. Proponents are being sought to work toward conservation and management of IBAs. These individuals and organizations will be champions for bird conservation at particular sites and will work cooperatively with each site's land manager or landowner. To some degree, additional site nominations are currently being sought, and missing information for accepted sites is being sequestered.

Another important part of the phase two process is monitoring birds at Idaho's IBAs. Monitoring already has been initiated at some sites – conducted either by biologists responsible for the management of the area, or by volunteers. These efforts, intended to collect basic information about the IBAs, at a minimum create an inventory of bird species present at each site, which will lead to further investigations. IBIS will initiate more extensive monitoring at all wetland IBAs and selected upland IBAs across the state. IBIS and Idaho's IBA program are strongly connected initiatives that require coordination and leadership to be fully effective. To this end, IDFG's Nongame Wildlife Program has hired a part-time IBA Coordinator so that IBIS may be implemented on a statewide basis by monitoring birds at IBAs. With a dedicated IBA Coordinator, Idaho's IBA program can continue to grow in the necessary direction and at the required pace to fulfill the objectives of this important state, national, and international bird conservation program.

Integrating Ongoing Surveys into a Coordinated Bird Monitoring Program

Integrating existing monitoring efforts is one of the main motivating factors for CBM at the state, regional, and continental scales. The purposes of integrating ongoing work into widely accessible databases are:

(1) Management agencies in need of specific bird conservation data can assess whether or not similar work has already been done;
(2) Resources can be more explicitly allocated to obtain information that is still lacking; and
(3) Information from local efforts can be utilized beyond the scope of single projects

Existing monitoring programs can contribute to the coordination effort by depositing data sets directly into a data repository, where they can be accessed either by a defined set of users or by the general public, depending on the nature of the data or restrictions set by the provider. Examples of such repositories, and the wealth of information they produce, are the BBS database of USGS' Patuxent Wildlife Research Center and the CBC program of the National Audubon Society. Repositories that can accommodate all types of bird monitoring data at a continental scale are currently being constructed, and the Patuxent Wildlife Research Center is already at a stage where most monitoring data collected in Idaho could potentially be stored.

In addition, IDFG's Nongame and Endangered Wildlife Program is currently working with the CDC to develop an Idaho version of a data bank that is tailored to facilitate access and use by Idaho partners. This version will be focused on Idaho issues, name places, and applications typical to management questions for this region. To contribute data from ongoing efforts, partners will be asked to provide the following information about their monitoring effort:

- Bird groups targeted
- Location data (coordinates and projection information)
- Type of monitoring data collected (presence/absence, abundance, density, demographics, etc.)
- Methods used (point count protocol, specifications for area searches, spot-mapping, nest monitoring, etc.)
- Type of habitat data collected (e.g., vegetation maps, vegetation structure data, floristics, etc.)
- Year(s) and season(s) of data collection
- Any restrictions on data (e.g., protection of location data on threatened and endangered species, expected publication dates at which data can be released to general use, etc.)
- Contact information for project lead

In cases where major restrictions on data exist, a contributor may make arrangements to only provide these metadata to the general public and to handle requests for raw data through the project's contact person.

Products of IBIS and Coordinated Bird Monitoring

Conceptually, coordinated bird monitoring can be divided into long-term and short-term objectives. Long-term programs implemented at the state level can be part of the continental program to obtain population trend estimates. Examples include the national BBS program, the national Breeding Pair survey for waterfowl, and national bird banding programs (e.g., MAPS).

Cooperators in state programs also agree to coordinate in carrying out short-term surveys designed for such goals as clarifying habitat relationships, estimating abundance, and evaluating projects. Thus, future revisions of IBIS involve re-evaluating short-term objectives and developing new ones. Short-term surveys are intended to address specific management issues that need to be resolved at a relatively large geographic scale, often involving multiple species and habitats. Management issues, survey objectives, methods, roles and responsibilities, and recommendations for implementation are developed during plan revisions (Table 1).

Table 1. Recommended steps for developing new short-term Coordinated Bird Monitoring projects.

Background and Description of the Management Issue
Survey Objectives
Information Needed
Study Areas
Focal Species
Quantitative Objectives
Methods
Bird Survey Methods
Sample Size Requirements
Habitat Variables
Sampling Plans
Roles and Responsibilities
Existing and Needed Information
Project Management
Recommendations for Implementation

Key Variables and Management Species in Short-term Coordinated Bird Monitoring Projects

Short-term surveys generally have one or more of three applications: regional models, site-based models, and project evaluation (Table 2). All three applications involve a set of one or more independent (predictor) variables and a dependent (response) variable. Sample size estimation procedures for the three applications are described in Appendix B. In most applications, predictor variables will be habitat descriptors, such as basic habitat type (e.g., derived from GAP or other habitat maps) for regional models, and more specific habitat descriptors (e.g., stand density, understory condition, forb cover) for site-based models. In project evaluation, the independent variable may be as simple as the presence/absence of a habitat implementation project, but also can include habitat characteristics that are a result of the project (e.g., tree densities after revegetation).

The response variable is typically: (1) a descriptor of bird abundance during any period of the year; (2) a variable describing demography; or (3) a fitness indicator, such as productivity or nutritional status. For most short-term products, we recommend using *total abundance of all management species* identified for that habitat type as the standard response variable. Management species include all species that are of greatest concern to the management issue. For the most part, management species lists are a combination of (1) threatened and endangered species, (2) high- and moderate-priority species of the

Table 2. Summary of typical products of short-term Coordinated Bird Monitoring projects.

Regional model

Description

A model that expresses the parameter of interest (e.g., focal species abundance) as a function of independent variables (e.g., habitat type) whose values are known throughout a region

Uses

- Understand large-scale patterns in abundance
- Estimate statewide population
- Identify low- and high-quality areas throughout the region

Methods

- Maps showing distribution of the focal habitat are obtained
- Regionwide bird surveys in the habitat, perhaps using stratification to insure samples are obtained from a variety of conditions
- Independent variables, suspected to be correlated with bird abundance (or other dependent variables), are obtained (usually from GIS layers) throughout the region
- Models are developed using standard regression methods

Site-based model

Description

Similar to the regional model but includes independent variables known only for the surveyed areas (e.g., understory type, tree density, burn history, etc.).

Uses

- Better understand determinants of habitat quality by including specific habitat variables not measurable statewide
- Estimate effects of proposed projects (e.g., habitat conversion/protection/restoration)

Methods

- Same methods as for the regional model
- In addition, stand-specific variables are collected by fieldwork, examination of aerial photos, or other sources

Project evaluation

Description

Estimated value of the parameter[1] (e.g., focal species abundance), within a habitat implementation project area, measured before, during, and after the project.

Uses

- Help evaluate habitat implementation projects, and perhaps revise project plans
- Document effects of the project on birds

Methods

- Surveys on the project area before, during and after the project

[1] The parameter of interest may be bird abundance during any period of the year or a fitness indicator such as productivity or nutritional status.

Partners-in-Flight state chapter's (IdPIF) priority species list, (3) highly imperiled, high concern, and moderate concern (categories 1 – 3) species of the U.S. Shorebird and Waterbird Conservation Plans, and/or (4) obligate breeders in the management issue habitat. Other bird population or community descriptors can also be used in data analyses, focusing for example only on the abundance or fitness of a single species of interest, or on the proportion of habitat obligates present. However, for the first phase of IBIS, we propose to emphasize fairly general analyses before moving into species-specific applications, for which additional statistical considerations will be necessary. One exception to this general focus concerns the Long-billed Curlew, a species of rapid growing concern in the West. A region-wide survey is being designed collaboratively by the USFWS and USGS, with curlew surveys beginning in Spring 2004. As part of the first phase of IBIS, we propose to contribute to this survey effort, even though it is species-specific.

Regional Models

Regional models express the parameter of interest (e.g., the abundance of a set of focal species) as a function of independent variables (usually habitat) whose values are known throughout a region. The model is applied to the entire region or, more typically, to all of a regional habitat type (e.g., aspen or shrub-steppe). The model may predict the abundance of a group of focal species, or it may be species-specific. The results of these analyses provide an estimate of region-wide species abundance, help managers understand large-scale patterns in abundance, and identify high- and low-quality habitats throughout the region. Models are constructed by obtaining field data from a substantial sample of randomly selected sites (usually using stratified sampling), and then identifying broadly-defined habitat variables, which are available in region-wide GIS layers, that are believed to correlate with bird populations.

Site-based Models

Site-based models also express the bird population parameters as a function of independent (usually habitat) variables. But in addition to variables whose values are known throughout the region, site-based models also include variables that were measured for each surveyed site and that are not available region-wide. These variables are usually habitat measurements that are obtained in the field or from detailed vegetation maps, aerial photos, or other supporting data. Results from these models usually make better predictions of bird population parameters for specific sites, and may reveal more about which habitat variables are correlated with bird population data than the region-wide model. Because, by definition, site models include variables whose values are not known region-wide, they cannot be extrapolated statistically to the entire region. However, basic habitat management guidelines derived from site-based models can be applied throughout the region for which habitat characteristics used in the site-based model are relevant. As a hypothetical example, if a site-based model for aspen were to predict a higher abundance of aspen-associated focal species with increased shrub coverage, then this insight can be applied to aspen management throughout the region in which aspen birds are believed to respond to this effect. Accuracy of site-based models is measured in the same way as for the regional models.

Project Evaluation

Project evaluations involve surveys on a habitat implementation project site before, during, and after the project. These surveys help evaluate, and perhaps revise, the project, as well as documenting effects of the project on birds.

Management Issues in Idaho

Discussions were held with habitat managers and wildlife biologists throughout Idaho to identify major bird conservation and management issues that IBIS should address. Nine issues were identified as the most pressing regional concerns at the time of this document's preparation:

1. Identifying species at risk and causes of declines
2. Inventory of IDFG Wildlife Management Areas (WMAs) for all birds in all seasons
3. Effects of wetland loss and degradation
4. Conflicts between piscivorous birds and fish populations
5. Effects of altering riparian habitats
6. Condition of aspen habitat and importance for birds
7. Identification of high quality habitat and effects of land-use practices in sagebrush communities
8. Forest thinning and fuels reduction projects, especially in Ponderosa Pine habitats
9. Effects of management in Pinyon-Juniper habitats

Each of these issues is discussed in more detail below. We describe the management issue and how information collected on bird surveys can help address it, suggest survey goals, assess how well existing programs are providing the needed information, and make recommendations for obtaining any needed additional information.

The discussions below frequently mention the number of species affected by a management program or that need to be investigated. These numbers were derived from a comprehensive list of focal species in Idaho. The list was prepared using the general criterion that we should monitor species we would try to conserve if we knew they were declining. It totals 306 species, which includes all game and nongame species that occur regularly in Idaho at any time of year, but it does not include species that are at the very edge of their range in Idaho. Appendix A provides the full species list, as well as information concerning each species' season of occurrence in Idaho, IdPIF priority level classification, and applicable management issue(s).

1. Identifying Species at Risk and Causes of Declines

Background and Description of the Management Issue

Many bird species are declining, or suspected to be declining, in Idaho and throughout the Intermountain West (Sauer et al. 1997). Unless declines are halted, some species will eventually warrant protection under the Endangered Species Act (ESA), a measure that is generally considered a last resort in species protection. Nearly all natural resource managers therefore recognize the need for a monitoring program designed to serve as an "early-warning" system that identifies declining species and causes of declines.

Identifying species at risk requires statewide collection of information on all 306 species regularly found in Idaho. For most nongame species, estimating trends solely for Idaho with sufficient precision is not feasible (Bart et al., *in press*). Instead, information from Idaho must be combined with information from surrounding states. Therefore, collaboration with other states is essential. Increasing sample sizes on the survey-level within Idaho is inefficient and provides relatively little increase in precision of the region-wide trend estimate for many species. An example from the Pacific Northwest for this phenomenon is provided by Bart et al. (*in press*).

Although information on abundance and productivity in different habitats also will be needed, it is much more expensive to obtain. Therefore, such efforts should focus on species and areas where potential threats or, conversely, opportunities to recover populations are most imminent (see management issues 3–9).

Survey Objectives

Information Needed: Permanent, annual surveys for all birds in all seasons conducted in a coordinated, standardized manner on a statewide basis; this is one of the primary goals of IBIS.

Study Areas: All sites identified in this plan (Appendix C), as well as at additional sites where appropriate opportunities occur.

Focal Species: All species identified in this plan as those that warrant monitoring (Appendix A).

Quantitative Objectives: We used an accuracy target for trends proposed by Bart et al. (*in press*), building on earlier work by Butcher et al. (1993): 80% power to detect a 50% decline, occurring during no more than 20 years, using a significance level of 0.10, a two-tailed test, and incorporating effects of potential bias. Achieving the target for every species is probably not realistic. Bart et al. (*in press*) suggested achieving the target for 80% of the species that occur regularly in North America as a reasonable goal. It is not expected that the target can be achieved within a single state. Bart et al. (*in press*) recommended that the target be achieved for each species' entire range or an area one-third the size of the temperate portion of North America, whichever was smaller. The objective for this management issue is 80% power to detect a 20-year decline of 50%, occurring in an area no larger than one-third of the temperate regions of Canada and the US, among 80% of the species that warrant monitoring.

Methods

Bird Survey Methods: A panel of experts at the continental level has evaluated which survey methods would best estimate long-term trends in population size, describe spatial patterns in abundance, and monitor fitness for all species regularly occurring in Canada and the US. The results for Idaho birds are summarized in Table 3. To the extent possible, these surveys will be conducted indefinitely at selected

Table 3. Number of species and dependent variables that would be monitored by each major survey method.

Survey Program	Season	Trends	Abundance	Fitness
1. Point counts and related programs	Breeding	162	168	0
2. Area surveys for landbirds	Year-round	34	183	0
3. Area surveys for aquatic birds	Year-round	53	69	60
4. Migration monitoring programs	Migration	59	0	147
5. Nest success programs	Breeding	0	0	244
6. Colony counts	Breeding	20	9	8
7. Aerial surveys	Year-round	31	31	0
8. Nocturnal surveys	Breeding	15	15	0
9. Upland gamebird surveys	Breeding	11	11	0
10. Other surveys	Year-round	25	24	18

sites (see Appendix C), many of which are IBAs and/or WMAs. Note that sites may be added or removed as opportunities arise or monitoring priorities change. Standardized protocols for waterbird surveys are described in detail in Appendix F; see also Bibby et al. (2000) for terrestrial birds and additional information.

Sample Size Requirements: To be determined following a more thorough assessment of accuracy targets.

Habitat Variables: Will vary considerably among sites, habitats, species, and management issues. Essentially requires the collection of habitat information necessary to determine reasons for documented population changes, if and where they occur. See management issues 3–9 for more specific details.

Sampling Plans: Sampling should occur indefinitely and on an annual basis at as many monitoring sites (Appendix C) as time and funding levels allow. If necessary, monitoring at sites may occur biannually to accommodate large numbers of samples distributed across an array of habitats (e.g., aquatic sites one year, terrestrial sites the next, and so on). To address this particular management issue, however, it is imperative that monitoring programs be established as long-term, permanent surveys conducted on a regular basis using consistent and standardized survey methods (see Table 3, above).

Roles and Responsibilities

Existing and Needed Information: Much information already exists about the distribution and status of birds in Idaho (e.g., Larrison et al. 1967, Burleigh 1972, Groves et al. 1997, Stephens & Sturts 1998). Although often species-specific, numerous unpublished reports and other gray literature on birds add to this volume of knowledge. Unfortunately, other than a few long-term monitoring programs (e.g., BBS, CBC, NRLBMP; see earlier descriptions), little information exists about the population trends of Idaho's birds, especially for aquatic species. Even for these monitoring programs, sample sizes are insufficient for many trends to be reliably determined, or data are restricted to only parts of Idaho. Moreover, most monitoring projects are conducted independently of other efforts and data are not pooled to examine larger-scale trends. IBIS intends to supplement these efforts by providing a framework for *coordinated statewide* monitoring of *all* birds where trend data from *vastly increased numbers of sites* will be submitted to a *central repository* for *large-scale* analyses.

Raptors are monitored in Idaho through nest monitoring, migration monitoring in the Boise Foothills, and some winter surveys, but statewide coverage is incomplete as of yet. This is also true for colony counts, migration monitoring of landbirds, productivity monitoring of landbirds, and surveys for nocturnal species. Because many of these call for specialized protocols, they are currently done based on local funding opportunities rather than with the intent to achieve comprehensive coverage. The long-term goal of IBIS includes sufficient coverage for these survey types to accommodate regional trend estimates on the parameters measured. Permanent funding on an annual basis is both required and expected.

Surveys that cannot be conducted using multi-species protocols will be constructed around existing survey efforts. For instance, surveys currently exist for the Bald Eagle (scientific names in Appendix A), Peregrine Falcon, Mountain Quail, Yellow-billed Cuckoo, Harlequin Duck, and Sandhill Crane (see above). Single-species surveys are needed, and will be incorporated into IBIS, such as for Black Swifts.

Project Management: Primary oversight is provided by the IBIS steering committee, which is comprised of representative biologists from state and federal agencies, non-governmental organizations (NGOs), universities, Native American tribes, and private industry. The IBIS steering committee is essentially the same as the IdPIF monitoring sub-committee and functions much like a Board of Directors. The primary role of the IBIS steering committee is to secure funding, foster key partnerships, guide the prioritization of monitoring efforts, and provide advice on overall project direction. IBIS is administered by IDFG's Nongame and Endangered Wildlife Program and is coordinated by a Wildlife Research Biologist. As

monitoring seasons come and go, temporary Wildlife Technicians are hired to assist the IBIS Coordinator with data collection. IBIS is part of the IDFG Nongame Bird Program (http://fishandgame.idaho.gov/wildlife/nongame/birds.cfm) along with IdPIF, the IBA program, BBS coordination, the Idaho Birding Trails project, and monitoring of special status species like Bald Eagles and Peregrine Falcons.

Annual reports to IBIS project partners will document accomplishments and outline future goals. Information collected as part of IBIS will be submitted to a central data repository currently under development; other components that contribute to larger, national programs (e.g., BBS) will continue to be sent to the appropriate location. Where feasible, existing monitoring efforts will be incorporated into the IBIS framework (e.g., Harlequin Ducks) to improve the spending efficiency of funds received for monitoring birds. The cost effectiveness of monitoring multiple species in a variety of habitats can usually be enhanced if monitoring is conducted in a coordinated manner under the auspices of one central program. Finally, the IBIS Coordinator will work closely with the IdCDC (http://fishandgame.idaho.gov/tech/CDC) to ensure that all records of Species of Special Concern and those deemed of "greatest conservation need" are reported for tracking/mapping purposes.

Recommendations for Implementation

- Implement IBIS (version 1.0) – a statewide waterbird/shorebird monitoring plan that estimates year-round bird use of Idaho's most important aquatic sites (primarily wetland IBAs) (Appendix C)
- Implement IBIS (version 2.0) when available – a statewide all-bird monitoring plan (i.e., both aquatic and terrestrial species)
- Increase coverage of Idaho's BBS routes
- Coordinate with IDFG to explore the option of using aerial waterfowl surveys to conduct shorebird counts
- Coordinate with IDFG to determine which, if any, other upland gamebird surveys are needed/desirable
- Increase coverage of raptor surveys, colony counts, and nocturnal species surveys (especially forest owls)
- Develop a general nongame database for existing and new monitoring programs
- Coordinate with other states of the intermountain west to increase effort toward productivity and migrant monitoring in the region

2. Inventory of IDFG Wildlife Management Areas (WMAs) for all birds in all seasons

Background and Description of the Management Issue

In 1940, IDFG purchased 171 ha in southern Idaho for the protection of critical waterfowl habitat and for recreational opportunities for hunters and anglers. This area eventually became known as the Hagerman WMA and the first of a network of areas managed by IDFG for the conservation of Idaho's wildlife and their habitats. The WMA program today operates under four basic goals: (1) to preserve and improve habitat for the production and maintenance of wildlife and fish populations; (2) to provide public hunting and fishing opportunities; (3) to provide non-consumptive wildlife and fish uses; and (4) to provide scientific, educational, and recreational uses not related to wildlife and fish (T. Parker, pers. comm.). Since 1940, IDFG has developed a network of 31 WMAs across the state, most of which constitute a mix of aquatic and upland habitats; many emphasize waterfowl production and are thus comprised of significant wetland complexes.

A variety of management practices occur within WMAs, most of which are geared toward maintenance, restoration, or creation of habitat for a group of target species (most often game species). These may include creation or restoration of wetlands for waterfowl (e.g., Boundary Creek WMA), planting both herbaceous and woody cover for upland game habitat (e.g., Carey Lake WMA), growing grain crops for waterfowl feeding (e.g., Fort Boise WMA), improving big game winter range (e.g., Tex Creek WMA), prescribed burning, thinning and selective green-tree harvest to restore historic forest types (e.g., Craig Mountain WMA), and treatment for noxious weeds (all WMAs). Wildlife Management Areas are part of IDFG's Habitat and Lands program, which is administered by the Wildlife Bureau at IDFG headquarters. Regional and District Habitat Biologists and Wildlife Technicians manage the WMAs.

In 2000, Karl et al. (*in press*) assessed the potential for IDFG's WMAs to contribute to the conservation of Idaho's wildlife. Predicted occurrences of species' habitats using GAP data were used to evaluate the representation of wildlife habitat and other ecological conditions. Karl et al. (*in press*) found 34 of 40 natural land cover types were mapped as occurring in WMAs. Wildlife Management Areas occurred in 10 of 15 of Bailey's ecoregion sections, absent only from 2 sections that occupy >1% of Idaho. Percent area of WMAs by elevation followed a pattern similar to percent area of Idaho; however, mean elevation for WMAs was lower than for the state. Habitat for 98.4% of Idaho's wildlife and all federal and state listed threatened, endangered, or candidate terrestrial vertebrates were predicted to occur in at least one WMA. Of the 372 (out of 379) terrestrial vertebrates predicted to occur in at least one WMA, 237 were birds. Habitat for 40 species (11 birds) was predicted to occur on <6 WMAs, and no habitat was predicted on WMAs for 6 species. In general, Karl et al. (*in press*) found the network of WMAs that was primarily established to protect game species has conserved many other aspects of Idaho's ecological diversity, provided habitat for >98% of Idaho's wildlife, and is complimentary to other protected areas in the state.

Unfortunately, species observation lists for many WMAs are either incomplete or out of date. Karl et al.'s (*in press*) study was based upon species lists from 22 WMAs, although 11 of them had obvious deficiencies (such as excluding a large taxonomic group or focusing on only waterfowl or large mammals). Of the remaining 11 WMA observation lists, biases still existed. For example, while the Craig Mountain WMA observation list was the only one based upon a thorough field inventory, even its bird list was biased toward songbirds and upland gamebirds, and away from waterfowl, waterbirds, and shorebirds. Karl et al. (*in press*) found adequate observation lists to assess accuracy of bird models on only 6 WMAs. To help improve the inventory data for IDFG WMAs, at least for bird species, we intend to conduct thorough surveys for all birds in all seasons. This is a short-term assessment that will likely take 2–3 years to complete and is an initial high priority management issue for IBIS to address. For those WMAs that are also IBAs, longer-term monitoring may continue beyond the initial field inventory; likewise, where opportunities arise to address other management issues on WMAs, additional work will occur as needed.

Survey Objectives

Information Needed: Complete and up-to-date inventories of all IDFG WMAs (all species in all seasons).

Study Areas: All 31 IDFG WMAs (Appendix C).

Focal Species: All species present.

Quantitative Objectives: To be determined on a site by site basis following initial site visits.

Methods

Bird Survey Methods: Will vary by habitat, but should follow protocols endorsed in this plan (see Appendix F for aquatic species). For terrestrial sites, use point counts for forest and shrubsteppe

communities, and line transects for riparian areas where habitat tends to be more linear. Area searches may be appropriate for some locations since the goal is to generate a species list more than it is to estimate trends. Indices of relative abundance would nevertheless be desirable. More intensive survey methods that yield information on density or demographics are not necessary. Protocols that emphasize nongame species are most likely to yield novel data since most WMAs have been well surveyed for gamebirds, especially waterfowl.

Sample Size Requirements: To be determined following a more thorough assessment of accuracy targets.

Habitat Variables: Likely to be minimal although basic assessments might be helpful is time and resources allow; detailed habitat information may already exist for some WMAs.

Sampling Plans: Surveys should cover all of a given site (i.e., there is no sampling in space). When this is not true, stratification is often useful, followed by systematic, or occasionally simple random, selection of plots. 1–2 visits are recommended each year for 1–3 years depending on the size of the WMA. Surveys to be conducted in all seasons to determine year-round inventory; note that different seasons can be sampled in different years. Length of surveys should be sufficient to have a 95% probability of detecting all species present at least once.

Roles and Responsibilities

Existing and Needed Information: Existing inventories vary by WMA, including both completeness (i.e., information on all species) and how recently they were conducted. Even where surveys are complete and up-to-date, they were conducted by different observers using nonstandardized protocols and over variable time periods. One benefit of IBIS addressing this management issue is that once inventories have been completed, it will be possible to comparatively rank all 31 WMAs using birds as an indicator of each WMA's ability to provide suitable habitat for an array of wildlife species. Such an exercise may help guide the need for different management practices on those WMAs found to lack high avian diversity or individual species considered indicative of "good quality" habitat. Only by trained observers with consistent skill levels conducting updated inventories using standardized protocols can such a statewide assessment of the entire WMA program be made. Thoroughly conducted inventories of all species in all seasons are needed.

Project Management: This issue will be managed by the IBIS Coordinator and Nongame Bird Program Coordinator in conjunction with the state Habitat Program Manager, Regional/District Habitat Biologists, and individual WMA managers. Designed to meet internal needs of IDFG, strong collaboration between the Nongame Wildlife and Habitat and Lands Programs will help direct this important component of IBIS.

Recommendations for Implementation

- Coordinate with state Habitat Program Manager to determine interest, necessary course of action, and appropriate procedures for contacting regional biologists and WMA managers
- Send out a letter to all regions explaining the desired project and perceived information need
- Request information from WMA managers regarding extent of existing inventory data, species lists, and logistical considerations for conducting a survey (e.g., need a canoe, road closures)
- Begin site visits in spring 2004 with an initial emphasis on aquatic sites
- Implement this component of IBIS more extensively in 2005–2006 by visiting more sites and conducting surveys in all seasons
- Enlist the help of regional nongame staff and habitat biologists where interest and time permits
- Generate species lists in collaboration with WMA managers, making sure to sample representative habitats throughout all WMAs

3. Effects of Wetland Loss and Degradation

Background and Description of the Management Issue

Wetlands are here defined as including lakes, reservoirs, playas, and marshes (i.e., "non-riverine wetlands" in IdPIF BCP). Wetlands of particular importance to birds in Idaho include Lake Lowell, Lake Pend Oreille, Coeur d'Alene Lake, Cascade Reservoir, American Falls Reservoir, and Camas Prairie Centennial Marsh; marshes at Camas, Bear Lake, and Grays Lake NWRs; and marshes at Oxford Slough and Market Lake (WMA) IBAs. Playas in the Great Basin BCR portion of the state (BMR-51), as well as water storage reservoirs, also may be important, especially for migrating birds, but are currently not well investigated.

Like most states in the Intermountain West, Idaho has lost a large portion of its wetlands. Fifty-six percent of the wetlands in Idaho have been lost in the past 200 years (Dahl 1990). Wetlands now comprise only 0.7% (385,700 ac; 156,200 ha) of the surface area of Idaho (Dahl 1990). Conversion to agriculture, drainage, and flooding by reservoirs are the main causes of wetland losses. Wetland loss, overgrazing, urban sprawl, and invasion by non-native plants are the main threats to wetlands today. Shallow wetlands and meadows have suffered the greatest losses.

Open-water wetlands are used for irrigation storage, fishing, and water sports. All of the larger lakes in Idaho and many of the smaller lakes have dams that maintain lake levels. Lake levels may be stabilized or manipulated at any time of the year for recreation, power, and irrigation. Altered hydrological regimes often reduce wetland habitat or convert it to a different type. Fluctuating levels in response to power or irrigation demands on some reservoirs have created steep eroding banks on islands and lake shores with little emergent habitat. Water fluctuations during the nest season can be detrimental, either by flooding nests or by leaving them dry and more exposed to mammalian predators. Fluctuations can cause some birds to abandon their nests. Boating can displace wildlife from open water habitats. Disturbance problems can be alleviated to some degree by providing refuge areas and by limiting human use during sensitive periods.

Open water habitat also is threatened by non-native plants, such as Eurasian watermilfoil (*Myriophyllum spicatum*), drainage, pollution, and sedimentation. Land use in emergent wetlands adjacent to open water habitat is limited due to accessibility. The main threats to these habitats include sedimentation, non-native species such as purple loosestrife, drainage, and pollution. These wetlands are difficult to use for agriculture unless they are drained. Some of the habitats in Idaho are also susceptible to flooding and drying, because water storage rights are owned by irrigation or power companies. Seasonally or semi-permanently flooded wetlands are used for grazing and are often drained to be used for farming and haying. Filling has resulted in the loss of these wetlands also. The non-native reedcanary grass (*Phalaris arundinacea*) often creates large monocultures in seasonally flooded wetlands that have been drained or have had high sediment inputs.

Each year, managers make decisions about how to allocate water among competing uses. In making these decisions, they need better information about how birds will be affected by alternative strategies. Surveying birds, recording water levels and assessing their effects on habitat availability for different foraging needs can provide this much needed information. This data collection process, at least for the waterbird and shorebird component, is not organized throughout the state at present. Therefore, one of the main recommendations will be to assess existing habitat information for aquatic birds in Idaho, and to coordinate collection of additional data as needed. Wildlife biologists, whom we consulted in preparing this plan, emphasized that models showing habitat relationships of wetland birds will be useful for optimizing water delivery for these groups with limited water available for these purposes. Therefore, the primary need is for site-specific models that predict bird use, at times of year that are most important to avian populations, as a function of water level. The development of site-specific models also will greatly

facilitate coordinated regional wetland management called for in both the Intermountain West Shorebird Plan and the Intermountain West Waterbird Plan.

Survey Objectives

Information Needed: Abundance data for all species groups throughout the year is needed. Although waterfowl abundance data may already be sufficient with existing IDFG survey efforts, additional data on waterbirds and shorebirds is needed. Surveys during migration are particularly important at many sites. Fitness indicators such as productivity and foraging success also are desirable.

Study Areas: This management issue can be addressed at any site included in this plan (see Appendix C) that has experienced loss and degradation of wetlands. More likely, however, since many of the sites at which we propose to conduct long-term population trend monitoring enjoy some level of protection (i.e., they are an IBA, a NWR, and/or a WMA), the best opportunities for addressing this issue may be elsewhere. Areas with documented information on loss and degradation should be a priority, as should sites where active restoration of degraded conditions is ongoing or planned. As with many of the management issues addressed by IBIS, the need to remain flexible, work collaboratively with willing partners, and take advantage of new situations is key.

Focal Species: Wetlands in Idaho are used regularly by 119 bird species including 68 management species (Table 4, Appendix A). Providing migration stop-over habitat is probably the most important function of Great Basin wetlands for many species of waterfowl, waterbirds and shorebirds. Lake Lowell of Deer Flat NWR, for example, is a site of regional importance for shorebirds. American Falls Reservoir is a major stop-over site for most aquatic species, and especially for shorebirds. Major breeding colonies of Western Grebes and Franklin's Gulls also depend on these habitats, and Grays Lake NWR supports the largest breeding concentration of Sandhill Cranes in the world. Many permanent wetlands serve as wintering habitat for waterfowl, such as Harriman State Park and Bear River NWR for Trumpeter Swans.

Table 4. List of management species and additional species that use wetland habitats as their primary breeding habitat. Management species for this management issue are in bold.

Common Loon	**Lesser Scaup**	**Semipalmated Sandpiper**
Pied-billed Grebe	**American Wigeon**	**Least Sandpiper**
Horned Grebe	**Northern Pintail**	**Baird's Sandpiper**
Red-necked Grebe	**Northern Shoveler**	**Pectoral Sandpiper**
Eared Grebe	**Blue-winged Teal**	**Long-billed Dowitcher**
Western Grebe	**Barrow's Goldeneye**	**Wilson's Snipe**
Clark's Grebe	**Ruddy Duck**	**Wilson's Phalarope**
American White Pelican	**Northern Harrier**	**Red-necked Phalarope**
Double-crested Cormorant	**Bald Eagle**	Sandhill Crane
American Bittern	**Peregrine Falcon**	**Franklin's Gull**
Great Egret	**Virginia Rail**	**Ring-billed Gull**
Snowy Egret	**Sora**	**California Gull**
Cattle Egret	**American Coot**	Caspian Tern
Black-crowned Night Heron	**Black-bellied Plover**	Common Tern
White-faced Ibis	**Snowy Plover**	**Forster's Tern**
Tundra Swan	**Semipalmated Plover**	**Black Tern**
Trumpeter Swan	**Killdeer**	**Short-eared Owl**
Canada Goose	**American Avocet**	**Great Gray Owl**

Mallard	**Black-necked Stilt**	White-throated Swift
Gadwall	**Greater Yellowlegs**	**Northern Rough-winged Swallow**
Green-winged Teal	**Lesser Yellowlegs**	Tree Swallow
Cinnamon Teal	**Willet**	**Marsh Wren**
Canvasback	**Spotted Sandpiper**	**Common Yellowthroat**
Redhead	**Upland Sandpiper**	**Yellow-headed Blackbird**
Ring-necked Duck	**Long-billed Curlew**	Red-winged Blackbird

Quantitative Objectives: Because most aquatic sites can be covered thoroughly by surveys, obtaining species-specific estimates of numbers present is probably feasible. More experience is needed in developing these models, but we believe that a reasonable initial target is that the CV of the predicted abundance for a single site should be ≤0.25.

Methods

Bird Survey Methods: Abundance of aquatic birds is usually determined using area searches by foot, boat, or plane across all of the site or in a series of randomly selected plots. Because vegetation may change between years, which could result in substantial changes in numbers recorded even if the number of birds present does not change, careful attention must be paid to estimating detection rates where birds are obscured by vegetation. Site descriptions, including survey protocols, are provided for all major aquatic sites in Idaho (Appendices D, E).

Sample Size Requirements: Because we lack information on the number of models required, and data have yet to be collected, sample size requirements are difficult to estimate at present. We believe a reasonable approach, given this uncertainty, is to suggest that monthly surveys be made on as many aquatic sites as possible. During 2004, an analysis of existing data should be conducted to determine how large a sample is needed to construct models that will achieve the accuracy target above.

Habitat Variables: Initially, the following habitat variables should be included in models: (1) water level data from staff gauges (or water delivery data in managed wetlands) obtained for each bird survey period; (2) topographic data that allow relating water level to water depth; and (3) vegetation maps that reveal wetland vegetation types.

Sampling Plans: Surveys usually cover all of a given site (i.e., there is no sampling in space). When this is not true, stratification is often useful, followed by systematic, or occasionally simple random, selection of plots. Survey times should be selected without regard to number of birds present (i.e., surveyors must avoid the tendency to do a survey *because* large numbers of birds are present).

Roles and Responsibilities

Existing and Needed Information: Idaho's waterbirds (and shorebirds) have not been previously monitored in any sort of statewide, coordinated manner. Surveys by Chuck Trost in the early 1990's provide the best information on status and distribution of colonial nesting waterbirds in southern Idaho. Other site-specific work (e.g., at Gray's Lake NWR and American Falls Reservoir) contribute to our understanding of how wetland loss and degradation might potentially impact some aquatic species. Basic information for much of the state and the majority of species is still lacking, however. Population trend estimates and specific effects of habitat loss are unknown. Filling this vital information gap is one of the priorities for the IBIS program and is the reason why initial implementation and v1.0 focuses on aquatic species.

In addition to the waterbird and shorebird surveys that we outline here, research to refine grazing guidelines in meadows and emergent wetlands is needed. The historical importance of fire in wetlands is not well understood, and many land-managing agencies are using prescribed fire with increasing frequency. Also, assessing the impacts of non-native plants and animals that are invading wetlands and reducing their value for native species is needed. In general, addressing these issues and initiating more long-term monitoring of waterbirds at wetland sites (both degraded and otherwise) will significantly improve our ability to protect Idaho's rich aquatic resources and their associated birdlife.

Project Management: The IdIBA program of the National Audubon Society has gathered information for key Idaho aquatic sites, including inventory data, conservation objectives and management issues that are being addressed by NWRs, WMAs and other entities managing large sites. Additional site information has been summarized in site descriptions for all wetland IBAs and WMAs in Idaho (Appendices D, E). In collaboration with IdIBA, IDFG and USGS are willing to compile and disseminate monitoring data that are already available and that are obtained in additional survey efforts. Regional analyses and data will be made available online, through reports to management agencies, and through peer-reviewed publications. This issue will continue to be directed primarily by the IdIBA program and its coordinator.

Recommendations for Implementation

- Complete the Idaho aquatic site assessment that has been drafted for the purpose of identifying wetland bird monitoring needs (Appendices D, E)
- Coordinate with IDFG, FWS, and IdIBA to determine which additional information on habitat use of aquatic birds would be most useful, given ongoing efforts
- Assess existing bird survey data, and implement new surveys, at focal sites for the modeling effort
  Assess existing supporting data (aerial photos, topographic maps, staff gauge data, etc.) that can be used in an analyses of geo-referenced count data
- Prepare prototype models from the most important sites, estimate the accuracy of predictions they make, and develop guidelines describing additional data needed
- Recruit volunteers (such as Audubon members) to conduct surveys at all wetlands as frequently as possible; use the results to improve the predictive power of the models, both at the focal sites (listed in Appendix C) and at others

4. Conflicts Between Piscivorous Birds and Fish Populations

Background and Description of the Management Issue

Increasing numbers of some species of fish-eating (piscivorous) birds in Idaho has led to increased concerns by anglers, fish culturists, and fisheries managers about possible negative impacts on populations of game fish. Bird-fish conflicts in Idaho can be generalized as one of two main issues: (1) impacts of piscivorous birds (especially Double-crested Cormorants and American White Pelicans) on trout (especially cutthroat trout, *Oncorhynchus clarki*) in the southeastern region of the state; and (2) bird predation on juvenile salmonids at Columbia and Snake River dams (especially by Caspian Terns). While other birds certainly eat fish (e.g., Belted Kingfisher, Osprey, Bald Eagle, Common Merganser, herons, grebes, and egrets), their impacts appear less significant and more dispersed throughout the state. Because cormorants, pelicans, and terns are colonially-nesting species that often concentrate in large numbers, and because they have increasing population trends in Idaho, concerns about impacts on fish by these species are the most serious. Internationally, interactions between piscivorous birds and fish, as well as implications for management, have recently been reviewed in Cowx (2003).

The Snake River and tributaries from the head of Walcott Reservoir near Burley to the Dam of Gem Lake Reservoir near Idaho Falls lie within IDFG's Southeast Region. From the early 1990s to the present there has been considerable concern by anglers about the possible impact of piscivorous birds on game fish populations. Fisheries most likely affected are 18,000 acre Blackfoot Reservoir, 48,000 acre American Falls Reservoir, 66 acre Springfield Reservoir, 25 acre McTucker ponds, 20 acre Rose pond, the Snake River above and below American Falls Reservoir and the Blackfoot River above Blackfoot Reservoir.

At Blackfoot Reservoir anglers see flocks in excess of 100 cormorants that follow newly released hatchery rainbow trout (*Oncorhynchus mykiss*). Biologists have documented pelican abundance near stocking sites increase from less than 1% of the total adult population prior to stocking to 13% immediately after stocking. To address anglers concerns, IDFG now stocks fingerlings in early spring before the pelicans and cormorants arrive at the reservoir and catchable size trout in the fall after the birds leave the area. IDFG fisheries biologists also are concerned about the impacts of large numbers of American White Pelicans on migrating native Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*). Because of very low water levels, the migration pathway for trout in Blackfoot Reservoir is currently extremely narrow and shallow. Notably, pelicans gather in large numbers along this pathway during trout migration. Numbers of trout trapped immediately upstream of the reservoir have decreased markedly in recent years, and the majority of trout trapped exhibit scars and wounds from bird strikes. Several deterrence methods have been implemented with varying success. There is an estimated 5-acre island in Blackfoot Reservoir where over 800 active pelican and over 300 active cormorant nests were recorded in 2004. Other birds nesting on the island include hundreds of ring-billed gulls and California gull and a small heron rookery. The number of nesting piscivorous birds increased during the 1990s (R. Scully, pers. comm.). The upper end of American Falls Reservoir, especially that portion within the Fort Hall Indian Reservation, contains large cormorant, heron and egret rookeries. Birds from these rookeries swarm when hatchery trout are stocked and result in calls from anglers for IDFG to protect the fish. Cormorants from this area also feed at McTucker Ponds, Springfield Reservoir, and on the Snake River above and below American Falls Reservoir.

Bird predation of juvenile salmonids was reviewed for 14 of the 18 mainstem dams on the Columbia and Snake Rivers by Bayer (2003). California Gulls, Ring-billed Gulls, Caspian Terns, Double-crested Cormorants, American White Pelicans, and several other bird species have been reported as predators of juvenile salmon and steelhead at these dams. Most estimates of the amount of this predation have been 2% or less of salmonids passing a dam. This is less than the percentage of juvenile salmonids killed during dam passage, and it has not been determined what proportion of salmonids taken by birds were already dead or mortally injured from dam passage. Thus, it is not clear what portion of bird predation is of viable salmonids that would have otherwise survived. Further, it appears that most juvenile salmonids in the Columbia Basin are not federally listed as threatened or endangered, so it is not known what impact bird predation at dams may have on listed salmonids. Nevertheless, predation may significantly affect certain salmon stocks, so it cannot be dismissed as unimportant (Bayer 2003).

The issue of bird predation on Columbia and Snake River smolts may not be as significant in Idaho as it is in Washington and Oregon (i.e., along the lower reaches of these rivers). For example, investigations by the Columbia Bird Research Group (http://www.columbiabirdresearch.org) indicated that Caspian Terns nesting on Rice Island, a dredged material disposal island in the Columbia River estuary, were the most significant avian predator of juvenile salmonids on the lower Columbia River. The Rice Island tern colony consisted of about 17,000 breeding adults in 1998, the largest known colony of Caspian Terns in the world. Diet analysis indicated that Caspian terns nesting on Rice Island consumed more juvenile salmonids than any other prey type (73% of prey items in 1997 and 1998). Using bioenergetics modeling, it was estimated that in 1998 Caspian Terns nesting on Rice Island consumed about 12.4 million juvenile salmonids (95% confidence interval = 9.1–15.7 million), or approximately 13% (95% c.i. = 9%–16%) of the estimated 97 million out-migrating smolts that reached the estuary during the 1998 migration year. Analysis of over 36,000 smolt Passive Integrated Transponder (PIT) tags recovered from

the Caspian Tern breeding colony on Rice Island revealed that over 13.3% of all PIT-tagged steelhead smolts that reached the estuary were consumed by terns in 1998 (D. Roby and K. Collis, unpubl. data).

One scenario that may increase the significance of this management issue in Idaho is the possible relocation of Caspian Terns from the Columbia River estuary to other breeding sites along the Columbia and Snake Rivers (Seto et al. 2003). If this occurs, and Idaho is selected to be a recipient of Columbia River birds, then knowing where these sites should be located and assessing the potential impacts on local fish populations are important steps to take.

Survey Objectives

Information Needed: Abundance and distribution data are needed throughout the year for all piscivorous bird species. Surveys during migration may be particularly important at many sites. Fitness indicators such as productivity and foraging success also are desirable. Behavioral data on diet choice and energy budgets (i.e., time spent foraging and in which habitats) are especially critical. Collaborative studies with fish biologists are essential to link bird use with fish presence and behavior.

Study Areas: Sites where there are known breeding colonies of Caspian Tern, Double-crested Cormorant, and American White Pelican (currently these are American Falls Reservoir, Bear Lake NWR, Blackfoot Reservoir, Deer Flat NWR, Island Park Reservoir, Minidoka NWR, Mud Lake WMA). In particular, Blackfoot Reservoir (at Gull Island), American Falls Reservoir, and Henry's Lake (are all known to have existing bird-fish conflicts related to unknown rates of fish depredation by birds. To address the impact of birds on smolts, study areas include the Snake River and its major tributaries throughout BMR-51.

Focal Species: There are 27 species of piscivorous birds that breed regularly in Idaho, including 5 species (American White Pelican, Double-crested Cormorant, Ring-billed Gull, California Gull, Caspian Tern) that have been frequently involved in bird-fish conflicts, and are therefore listed below as management species for this issue. An additional 10 species of piscivorous birds are present in Idaho during migration and/or winter.

Table 5. List of piscivorous bird species of Idaho (primary piscine biomass consumers, not all species that have been documented to eat fish). Management species for this management issue are in bold.

Red-throated Loon	Great Egret	Mew Gull
Pacific Loon	Snowy Egret	**Ring-billed Gull**
Common Loon	Green Heron	**California Gull**
Pied-billed Grebe	Cattle Egret	Herring Gull
Horned Grebe	Black-crowned Night Heron	Glaucous-winged Gull
Red-necked Grebe	Hooded Merganser	Glaucous Gull
Eared Grebe	Common Merganser	Sabine's Gull
Western Grebe	Red-breasted Merganser	**Caspian Tern**
Clark's Grebe	Osprey	Common Tern
American White Pelican	Bald Eagle	Forster's Tern
Double-crested Cormorant	Franklin's Gull	Black Tern
American Bittern	Bonaparte's Gull	Belted Kingfisher
Great Blue Heron		

Quantitative Objectives: Because most aquatic sites can be covered thoroughly by surveys, obtaining species-specific estimates of numbers present is probably feasible. More experience is needed in developing these models, but we believe that a reasonable initial target is that the CV of the predicted abundance for a single site should be ≤0.25.

Methods

Bird Survey Methods: Abundance of aquatic birds is usually determined using area searches by foot, boat, or plane across all of the site or in a series of randomly selected plots. Because vegetation may change between years, which could result in substantial changes in numbers recorded even if the number of birds present does not change, careful attention must be paid to estimating detection rates where birds are obscured by vegetation. Site descriptions, including survey protocols, are provided for all major aquatic sites in Idaho (Appendices D, E).

Sample Size Requirements: Because we lack information on the number of models required, and data have yet to be collected, sample size requirements are difficult to estimate at present. We believe a reasonable approach, given this uncertainty, is to suggest that monthly surveys be made on as many aquatic sites as possible. During 2005, an analysis of existing data should be conducted to determine how large a sample is needed to construct models that will achieve the accuracy target above.

Habitat Variables: Initially, the following habitat variables should be included in models: (1) water level data from staff gauges (or water delivery data in managed wetlands) obtained for each bird survey period; (2) topographic data that allow relating water level to water depth; and (3) vegetation maps that reveal wetland vegetation types.

Sampling Plans: Surveys usually cover all of a given site (i.e., there is no sampling in space). When this is not true, stratification is often useful, followed by systematic, or occasionally simple random, selection of plots. Survey times should be selected without regard to number of birds present (i.e., surveyors must avoid the tendency to do a survey *because* large numbers of birds are present).

Roles and Responsibilities

Existing and Needed Information: There have been no studies to document the impact of piscivorous birds on Idaho's fisheries. In 1991, fish culturists operating a trap on the Blackfoot River one mile above Blackfoot Reservoir found that 10% of the adult Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) trapped had scars that appeared to have come from birds (R. Scully, pers. comm.). This presents the question of what percent of pre-spawning cutthroat that are caught by birds manage to escape. If the escapees are a small percent, then the predation impact is large, if not then the impact is small. Anglers and landowners along the Blackfoot River frequently tell IDFG personnel of the pelicans and cormorants that they see and of their concern for the cutthroat trout. The spring run of cutthroat trout and Utah sucker (*Catostomus ardens*) are mostly temporally separated, with trout migrating before water reaches 50°F and suckers coming when water is warmer. Many of the piscivorous bird observations come when only cutthroat are migrating.

The best quantitative information from IDFG's Southeast Region is from 66-acre Springfield Reservoir. In 1994, IDFG reported that although the reservoir was stocked with 129 catchable size (9-inches) rainbow trout per acre the first week of May, almost none of these fish were observed in a subsequent creel survey (R. Scully, pers. comm.). Angry Memorial Day weekend anglers accused IDFG of lying and not stocking any trout. An additional 8,500 trout were stocked and daily observations on bird activities were made at the reservoir. It was found that on the day of stocking few piscivorous birds were present. However by the fourth day after stocking over 200 cormorants were observed at a given time. A week later, gillnet and electrofishing surveys found very few trout, but did catch large numbers of Utah chubs (*Gila atraria*) of the same size as the stocked trout. It appears that the naïve newly stocked trout had

been quickly removed whereas the cautious chubs survived; alternatively, there was a preference by the birds for the trout.

Quantitative studies are needed on the impacts to sport fisheries of avian piscivory in selected Southeast Idaho waters. Fisheries that would likely benefit most from such a study are Blackfoot Reservoir and the upper Blackfoot River. The study should address what impact birds are having on IDFG's efforts to recover wild Yellowstone cutthroat trout in the reservoir and river, as well as determine what impact birds have on the hatchery rainbow trout stocked into Blackfoot Reservoir. A possible outcome of the study might be that birds mainly eat the abundant nongame Utah chub, Utah sucker, and common carp (*Cyprinus carpio*). Should this be case it would answer the question of whether or not birds are limiting the fisheries and end the frequent complaints by anglers that birds are destroying the fisheries and that IDFG does nothing about it.

Project Management: Monitoring to address this management issue requires strong coordination between wildlife and fisheries biologists; within IDFG, collaborative studies between regional Nongame and fisheries biologists are recommended. IBIS is provided as a framework for monitoring birds, potentially providing technical assistance and/or personnel to conduct field surveys where necessary. Information on the distribution and abundance of colonial-nesting waterbirds will be maintained by IDFG as part of IBIS and the IdIBA program.

Recommendations for Implementation

- Assess existing bird survey data, and implement new surveys, at focal sites for the modeling effort
- Review current knowledge about perceived conflicts between piscivorous birds and fish
- Work with research and fisheries biologists involved in ongoing assessments to determine the role that IBIS could play in addressing this management issue
- Conduct intensive behavioral observations of management species to determine food habits and time budgets related to foraging
- Recruit volunteers (such as Audubon members) to conduct surveys at proposed study areas as frequently as possible; use the results to improve the predictive power of the models, both at the focal sites (listed in Appendix C) and at others

5. Effects of Altering Riparian Habitats

Background and Description of the Management Issue

Riparian habitats are here defined to include rivers, lowland springs and streams, and montane streams. Major rivers include the Kootenai, Palouse, St. Joe, Clearwater, Lochsa, Selway, Salmon, Lemhi, Pahsimeroi, Snake, Owyhee, Bigwood, Payette, and Blackfoot. Lowland springs and streams occur throughout southern Idaho, with the exception of the eastern portion of PIF Planning Unit 89, which is noticeably lacking waterways. Montane streams are found primarily in the northern half of Idaho, corresponding with the boundaries of BMR-50.

Riparian areas are among the most heavily impacted environments in Idaho. The natural hydrographs of nearly all major rivers have been altered by channelization, dams/reservoirs, and water diversions. Prior to Euro-American settlement, most large rivers throughout Idaho spread across wide valley bottoms and supported forested and shrub wetlands, ponds, wet meadows, and marshes. Throughout the last century, dikes or levees were constructed in many of these systems to contain spring floods. Cottonwood forests were removed and wetlands were drained or filled for agricultural development.

Regulating flows for irrigation, power production, and flood control have altered the natural regeneration process.

The impacts of the widespread removal of beaver during the 1800s from riverine systems throughout the West have not been well-studied (Knopf & Scott 1990). However, based on our current understanding of the effects of beaver activity on riverine systems, the impacts of their removal can be surmised. The more obvious impacts include lower water tables, release of sediments and nutrients from impounded systems, a decrease in forest canopy resulting from tree cutting, less diversity of successional stages often resulting from dam breakage/abandonment and subsequent exposure of mudflats, and a preponderance of riverine systems less resistant to disturbance events. Clearly, beaver were an integral component of the broad valley bottom riparian complex in Idaho under historical conditions. Additional studies are needed to better understand the implications of beaver removal on the plant and animal communities and disturbance processes of the broad valley bottom riparian complex.

Pasture development and the elimination of willows has converted large portions of the broad valley bottoms of the Caribou and Preuss ranges from dominance by scrub-shrub vegetation to dominance by emergent vegetation. Seeding with nonnative grasses and ditching has altered the structure of meadows. Grazing also suppresses cottonwood and willow regeneration. Cottonwood communities have been degraded, sometimes severely, from cattle or domestic sheep in many areas. Grazing can eliminate cottonwoods or reduce age-class diversity. Grazing decreases the vigor and biomass of riparian shrubs, and alters species composition and diversity in riparian communities (Bryant et al. 1972; Ames 1977).

Establishment of noxious weeds in riparian habitats may simplify the vegetation structure. Leafy spurge (*Euphorbia esula*) and spotted knapweed (*Centaurea biebersteinii*) are noxious weeds that are well established on riparian terraces and benches in portions of Idaho. Purple loosestrife (*Lythrum salicaria*) may become established in backwater sloughs and other moist swales. Other noxious weed species that may be problematic within, and adjacent to, riparian habitats include pepperweed whitetop (*Cardaria draba*), Russian knapweed (*Acroptilon repens*), Canada thistle (*Cirsium arvense*), poison hemlock (*Conium maculatum*), black henbane (*Hyoscyamus niger*), and dalmatian toadflax (*Linaria genistifolia*).

Improper timber harvest removes woody materials that are needed by riparian systems for nutrients, and for coarse debris to slow water run-off and create habitat for fish and invertebrates. Improper timber harvest also has increased run-off and sediment-loading in streams. Adjacent timber provides shade, preventing water temperature fluctuations that can harm aquatic life (Mehan et al. 1977).

Development of second homes and ranchettes is common along most rivers in Idaho. Riparian corridors are popular for development and create areas that restrict wildlife migration from uplands to wetlands, restrict migration along riparian corridors, and create the need for flood control measures to protect properties. Impacts due to road construction and home building will likely surpass agricultural impacts as population increases and economies switch from agricultural-based to service-based.

A number of riparian/wetland restoration projects are ongoing around the state with some of the best examples coming from eastern Idaho. For example, the Teton Regional Land Trust (TRLT) and various private landowners are actively engaged in restoring/creating/enhancing high quality riparian, wetland and associated upland habitat on conservation easement properties. Most projects to date are designed to create productive waterbird habitat to maintain population viability of high priority wildlife species in the face of accelerated commercial/residential development and the subsequent loss of wetlands in Teton County, Idaho. Target species for habitat restoration efforts include Trumpeter Swan, Long-billed Curlew, Willet, Sandhill Crane, Wilson's Phalarope, migrating shorebirds, migrating and breeding waterfowl, herptiles, and native trout. TRLT has received three North American Wetland Conservation Act (NAWCA) grants totaling 2.6 million dollars for wetland protection and restoration in Teton Basin. Additional funding partners include the USFWS, IDFG, Ducks Unlimited, and numerous private donors. Full-scale restoration has been completed, or is in progress, on 12 conservation easement properties.

These properties are in various stages of project maturity and will include approximately 2,500-acres of restored/enhanced wetlands and associated upland habitat in Teton Basin. In 2003 the USFWS presented TRLT with the National Wetlands Conservation Award to the Private Sector for excellence in developing, restoring, and enhancing wetlands. TRLT is currently working to expand its habitat restoration efforts to include selected areas along the Henry's Fork River.

Managers working in riparian areas primarily need two kinds of information: predicted effects of proposed habitat implementation projects on birds, and actual effects of implemented projects. A site-based model is needed to provide the first kind of information; project evaluations are needed to produce the second kind of information. See "Products of IBIS and Coordinated Bird Monitoring" section (above) and Appendix B for more information about site-based models.

Survey Objectives

Information Needed: Although project evaluations should, at a minimum, document breeding abundance of management species, management species abundance throughout the year and measures of fitness, including productivity during the breeding season and foraging success during migration, also would be highly desirable. Proper Functioning Condition (PFC) may also be assessed using relatively simple bird survey techniques (e.g., Rich 2002).

A site-based model should predict management species abundance relative to a continuum in habitat conditions influenced by fire, grazing, and restoration treatments. Models should be generated for both breeding and migration. As projects are implemented, short-term trends in abundance also may be of interest, particularly in large projects.

Study Areas: This management issue can be addressed at any number of riparian sites throughout the state. Given the wide array of disturbances that regularly alter riparian habitats (reviewed above), and as with many of the other management issues addressed by IBIS, opportunities will be varied and often unpredictable in space and time. Some of the best opportunities will occur at sites where riparian bird monitoring has been ongoing in the past, thereby providing baseline data prior to habitat alterations taking place. Note also that monitoring the effects of changing riparian habitat should not necessarily always focus on negative changes; assessing the response of birds to riparian restoration efforts (such as the work of the Teton Regional Land Trust in the Teton Valley of eastern Idaho) is extremely valuable.

Focal Species: Of the 242 naturally occurring bird species breeding in Idaho, 112 (46%) use riparian habitat for nesting. Many of the other 54% also use riparian habitat as a source of water, as migratory corridors, or for other purposes. Compared with all other habitats that occur in Idaho, and even though it covers <1% of the landscape, riparian habitat is used disproportionately by breeding birds. Of the 119 Neotropical migrants that breed in Idaho, 68 (57%) use riparian habitat, and some are considered specialists, only being found in this habitat (e.g., Yellow-billed Cuckoo, Willow Flycatcher, Yellow Warbler). In total, riparian areas in Idaho are used by 141 bird species, including 30 management species for this objective (Table 6, Appendix A).

Table 6. List of management species and an additional 57 species that use riparian habitats as their primary breeding habitat. Management species for this management issue are in bold.

Great Blue Heron	Black-chinned Hummingbird	Gray Catbird
Wood Duck	**Calliope Hummingbird**	Northern Mockingbird
Harlequin Duck	Broad-tailed Hummingbird	Bohemian Waxwing
Bufflehead	Rufous Hummingbird	**Orange-crowned Warbler**
Common Goldeneye	**Belted Kingfisher**	Nashville Warbler

Barrow's Goldeneye	Downy Woodpecker	**Yellow Warbler**
Hooded Merganser	**Lewis's Woodpecker**	Yellow-rumped Warbler
Common Merganser	**Red-naped Sapsucker**	**American Redstart**
Osprey	Northern Flicker	Northern Waterthrush
Bald Eagle	Western Wood-Pewee	**MacGillivray's Warbler**
Sharp-shinned Hawk	**Willow Flycatcher**	Common Yellowthroat
Cooper's Hawk	**Dusky Flycatcher**	**Wilson's Warbler**
Northern Goshawk	Western Kingbird	**Yellow-breasted Chat**
Swainson's Hawk	Eastern Kingbird	Western Tanager
Red-tailed Hawk	Plumbeous Vireo	**Song Sparrow**
Merlin	Warbling Vireo	**Lincoln's Sparrow**
Ruffed Grouse	Red-eyed Vireo	White-crowned Sparrow
Blue Grouse	Black-billed Magpie	Black-headed Grosbeak
Mountain Quail	American Crow	Blue Grosbeak
Sandhill Crane	**Northern Rough-winged Swallow**	**Lazuli Bunting**
Killdeer	Black-capped Chickadee	**Brewer's Blackbird**
Spotted Sandpiper	Bushtit	Common Grackle
Caspian Tern	Bewick's Wren	Great-tailed Grackle
Yellow-billed Cuckoo	House Wren	Bullock's Oriole
Western Screech-Owl	**Marsh Wren**	Scott's Oriole
Long-eared Owl	**American Dipper**	House Finch
Northern Saw-whet Owl	Blue-gray Gnatcatcher	Lesser Goldfinch
Black Swift	**Veery**	American Goldfinch
White-throated Swift	American Robin	House Sparrow

Quantitative Objectives: Although species-specific estimates of abundance are desirable, they often cannot be obtained with sufficient precision to be useful. As an alternative, we define the primary parameter of interest as the mean number of individuals of all riparian management species recorded with a large sample.

The desired accuracy of models to predict abundance, should a proposed project be implemented, must be established independently of specific projects. More experience is needed in developing these models for riparian habitats in Idaho, but we believe that a reasonable initial target is that the CV of the predicted abundance for a single project area should be ≤0.25.

Because projects affecting riparian habitat often cause major changes in habitat, and therefore bird abundance, surveys can be designed to detect large, rather than small, changes. As an approximate guideline, it seems reasonable that power to detect a 2–3 - fold change should be at least 80%. Whereas detecting a 2-fold change (lower precision than 3-fold) may be appropriate for smaller projects, detecting a 3-fold change may be more appropriate for larger projects.

Methods

Bird Survey Methods: Abundance of landbirds during the breeding season is usually determined using point count or line transect surveys; the latter are especially appropriate for linear habitats typical of riparian areas. Point counts were used by Rich (2002) to assess riparian health and provide a simple tool with which to address PFC of western riparian systems in general. Demographic data collected using constant-effort mist-netting stations or nest monitoring programs also are encouraged where possible.

Sample Size Requirements: To be determined following a more thorough assessment of accuracy targets.

Habitat Variables: Habitat data already exist for several projects and may be supplemented with data from additional sites to increase our knowledge of habitat associations. This information is essential in developing the predictive model since the predictions are based on habitat variables (defined broadly). Habitat variables may include predictors such as width of riparian woodland corridor, total woodland cover, cover by exotic shrubs and trees, measures of foliage height diversity, cover by native understory species, cover by floodplain wetlands, and emergent vegetation cover.

Sampling Plans: Project evaluation surveys probably should employ one-stage systematic sampling, perhaps preceded by stratification, when project areas are small enough for this to be feasible, and should use multi-stage sampling when the strata are too large for this approach. Precision will generally be higher, for a fixed number of stations, with the first approach.

The same general approach will probably work to gather data for development of the site-based predictive model, although in most cases strata will be large enough that clusters of point count stations will be used. Strata should be delineated to insure that a wide range of habitat types is included. Analysis should acknowledge the stratification and multi-stage nature of the sampling plan.

Finding high-quality sites may be especially difficult. The St. Joe or Kootenai River may provide the best site for developing the model for northern rivers. Lower Henry's Fork or Big Lost River may be most useful in developing the model for southern rivers and springs. For montane streams, several exclosure sites could be used as reference sites, such The Nature Conservancy's Silver Creek Preserve. However, other areas may also provide useful information on reference conditions.

Roles and Responsibilities

Existing and Needed Information: Few examples of long-term monitoring of riparian birds in Idaho exist. Near Salmon, in east-central Idaho, H. Ulmschneider (unpubl. data) monitored changes in riparian bird communities in response to altered grazing regimes for 8 years. Point-count transects (9–22 points/transect) were visited once per year on each of 7–15 creeks; points were 125–250 m apart, counts lasted 6 min, and all species detected, regardless of distance from observers, were recorded. Cattle were excluded by the BLM from some creeks permanently and from others temporarily (e.g., during several weeks in the spring). Increases in numbers of birds, but not numbers of species, were documented, especially for some riparian-obligates such as the Willow Flycatcher (H. Ulmschneider, unpubl. data).

Breeding birds in cottonwood gallery forests along the South Fork of the Snake River in eastern Idaho were studied by Saab (1998); the distributions of several species were found to be influenced by livestock grazing, recreational activities, and cottonwood patch sizes. Ground-nesting species, the Veery and Fox Sparrow, were most susceptible to disturbances created by livestock grazing and also were most sensitive to fragmentation of riparian habitats. Five species, the American Goldfinch, Yellow Warbler, Veery, Black-headed Grosbeak, and Gray Catbird, were unaffected by patch size in unmanaged areas, but showed significant area effects (increases in probability of occurrence with increases in forest area) in grazed and/or recreation sites. These results suggest that conservation of large patches is particularly important where riparian forests are managed for grazing and recreation (Saab 1998).

Of greatest need are data that document responses of bird communities to the major disturbances that continue to threaten Idaho's riparian habitats. Information should be on species composition and indices of abundance at a minimum, and population health and viability whenever possible. Using key indicator species (e.g., Yellow Warbler or Song Sparrow; see Rich 2002) to assess the quality of riparian habitat is an area in need of further investigation. Moreover, understanding the relationship between abundance

and productivity would be helpful in knowing whether or not habitat quality could be reliably inferred from simple bird survey data. In general, however, long-term population monitoring in both degraded and improved (actively restored) riparian habitats will greatly increase our ability to help land managers make informed decisions about how to maintain, create, and preserve important riparian habitats for birds.

Project Management: With primary project oversight coming from the IBIS steering committee, this issue will be managed through the collaborative efforts of the IDFG Nongame Bird Program, IdPIF, agency biologists, NGOs, and concerned citizens. Cooperative projects with the IdCDC to track birds at high quality sites is recommended.

Recommendations for Implementation

- Continue project monitoring that is ongoing until scientific evaluation is possible
- Fill gaps in survey coverage sufficiently to develop riparian site-based models
- Evaluate restoration and other habitat modification projects that are not sufficiently monitored at present
- Provide an information network among managers and scientists that identifies upcoming projects for pre- and post-project bird monitoring

6. Condition of Aspen Habitat and Importance for Birds

Background and Description of the Management Issue

Quaking aspen (*Populus tremuloides*) mostly occurs in eastern and south-central Idaho (Mueggler 1988; Steele undated). However, it also occurs in northern Idaho, occurring over broad elevations and in many habitat types, most frequently occurring in stands of mixed hardwoods (including birch and cottonwood) and mixed conifers (S. Jacobson, pers. comm.). Aspen is a seral species in habitat types where conifer trees are climax, but also occurs as a stable type (de facto climax), and as a grazing disclimax (Mueggler 1988). In the Northern Rocky Mountains, which include central and northern Idaho, aspen communities are relatively infrequent and small, the size of individual stands seldom exceeding 5 ac (2 ha; Mueggler 1985). In eastern Idaho, northern Utah, and western Wyoming, aspen communities can be either small patches or large stands. Aspen make up only a minor component of the Idaho landscape but support a significant number of priority and management species.

A gradual loss of aspen appears to be occurring in Idaho and elsewhere in the Intermountain West (e.g., Wall et al. 2001). The immediate cause appears to be regeneration failure within stands leading to stand loss, and a failure of new stands to develop. Recreational activities, improper grazing practices within stands, and climate change have been identified as possible causes of the decline. Managers need better information on the importance of aspen stands to birds in Idaho. Specific topics of interest include identifying bird species that depend on aspen to reach their highest abundance and/or fitness, and describing the characteristics of aspen stands (e.g., patch size, understory development, tree size) that determine habitat quality for aspen birds. This information will help managers determine the importance of research on aspen, which habitat elements matter most to birds, and will help identify stands which should be protected.

The greatest need is for a statewide model that describes the overall importance of aspen to birds and that identifies habitat features most strongly correlated with bird abundance and fitness. A few areas, however, are of particular concern and may warrant site-based models and project evaluation. For instance, the US Forest Service is particularly interested in the value of aspen in eastern Idaho, since concerns for aspen loss have been identified as a primary land management issue of these areas.

Survey Objectives

Information Needed: Models are needed to predict abundance and productivity of birds in aspen during the breeding season, as well as abundance and fitness of birds in aspen during migration. Abundance is here defined as the mean number of birds detected in a 10-minute point count in a circle with 50-m radius. A more biologically relevant definition (e.g., density of territorial males and their mates) may be used in future studies.

Study Areas: Wherever aspen occurs in Idaho, as both a seral and climax species. Eastern Idaho provides the best opportunities to address this management issue given the amount of aspen that occurs in this part of the state. Both public and private lands should be considered when designing projects to allow for a range of management activities and habitat conditions to be examined. IDFG WMAs Tex Creek and Sand Creek both contain significant amounts of aspen and therefore provide opportunities to study birds and address effects of habitat condition and management activities.

Focal Species: Aspen habitats are used by at least 34 bird species; 4 of them are Idaho species of special concern including Northern Goshawk, Flammulated Owl, Northern Pygmy-Owl, and Boreal Owl (Table 7, Appendix A). An additional 4 species (Blue Grouse, Williamson's Sapsucker, Red-naped Sapsucker, and Hammond's Flycatcher) are considered "high priority species" by Idaho Partners in Flight. Aspen are heavily used in the breeding season and may be important for migrants, although this issue is not well-studied.

Table 7. List of species that regularly use aspen habitats of Idaho. Management species for this management issue are in bold.

Sharp-shinned Hawk	Broad-tailed Hummingbird	Black-capped Chickadee
Cooper's Hawk	Rufous Hummingbird	**Mountain Chickadee**
Northern Goshawk	Northern Flicker	House Wren
Red-tailed Hawk	**Williamson's Sapsucker**	Golden-crowned Kinglet
Ruffed Grouse	**Red-naped Sapsucker**	Swainson's Thrush
Blue Grouse	Downy Woodpecker	European Starling
Flammulated Owl	Western Wood-Pewee	Orange-crowned Warbler
Western Screech-Owl	**Hammond's Flycatcher**	Yellow-rumped Warbler
Great Horned Owl	**Dusky Flycatcher**	Northern Waterthrush
Northern Pygmy-Owl	Cordilleran Flycatcher	**Western Tanager**
Long-eared Owl	Warbling Vireo	
Boreal Owl	Tree Swallow	

Quantitative Objectives: Statewide (regional) and site-based models are needed. Although no specific projects have been identified at the time of this draft, project evaluations also will likely be needed. The regional model will permit a statewide evaluation of the importance of aspen to birds and identification of large-scale patterns in aspen use. The site-based model will help reveal which traits of aspen stands (including landscape variables) are most highly correlated with bird abundance in aspen. See "Products of IBIS and Coordinated Bird Monitoring" and Appendix B for more information about regional and site-based models. We suggest that species-specific and multi-species versions of each model be constructed. More work is needed on reasonable accuracy targets for these models. Interim targets are CV<0.5 for the species-specific models and CV<0.25 for the multi-species models.

Methods

Bird Survey Methods: The standard point-count survey sampling protocol (Ralph et al. 1993) will be used to estimate relative avian abundance. Demographic work to assess the health and viability of breeding bird communities should include nest searches and nest monitoring. The study design and sampling regime used by Sallabanks et al. (*in press*) provide an appropriate framework for generating baseline information for birds breeding in aspen habitats of Idaho.

Sample Size Requirements: To be determined following a more thorough assessment of accuracy targets.

Habitat Variables: Habitat variables for the regional model should include stand size and elevation, and may also include measures from geo-referenced data sources, such as soil type, slope, and aspect. Habitat variables for the site-based model should include measures of dominant plant taxa, stand density, and height of (1) grass-forbs, (2) shrubs and saplings, (3) understory trees, and (4) overstory trees. Average diameter-at-breast-height of overstory trees and overstory canopy cover also should be assessed.

Sampling Plans: Surveys probably should employ one-stage systematic sampling, perhaps preceded by stratification, when project areas are small enough for this to be feasible, and should use multi-stage sampling when the strata are too large for this approach. Precision will generally be higher, for a fixed number of stations, with the first approach. The same general approach will probably work to gather data for development of the site-based predictive model, although in most cases strata will be large enough that clusters of point-count stations will be used. Stratification should be considered to insure that high-quality stands are included in the sampling; habitat assessment may need to precede bird surveys to determine which sites are high quality – collaborative projects with the IdCDC may prove beneficial in this regard. Analysis should acknowledge the stratification and multi-stage nature of the sampling plan.

Roles and Responsibilities

Existing and Needed Surveys: Few data exist on relationships between the condition of aspen stands and bird communities in Idaho; information on avian population health in this important habitat also are lacking. Basic descriptions of aspen bird community composition, relative abundance of species, and stand condition are needed. Secondarily, more intensive monitoring of demographic parameters across an array of stand conditions is desirable. To address the management issues that relate to aspen, surveys in both degraded and protected (restored) stands are necessary. Initial surveys (2005–2006) should focus on establishing baseline (reference) conditions, locating areas for long-term population trend monitoring, and identifying potential target species and study sites for more intensive assessments of highest priority management issues.

Project Management: With primary project oversight coming from the IBIS steering committee, this issue will be managed through the collaborative efforts of the IDFG Nongame Bird Program, IdPIF, agency biologists, NGOs, and concerned citizens. Cooperative projects with the IdCDC to track birds at high quality sites is recommended.

Recommendations for Implementation

- Obtain available information from existing aspen stand assessments
- Decide on final list of additional habitat variables and how they will be measured for both models
- Obtain additional habitat variables for existing surveys, as needed
- Carry out preliminary analyses for the statewide model (before the 2006 field season)
- Locate aspen stands for baseline monitoring

- Initiate point-count surveys in selected areas
- Identify future management issue projects and target species/study sites

7. Identification of Quality Habitat and Effects of Land-Use Practices in Sagebrush Communities

Background and Description of the Management Issue

Shrubsteppe is widely recognized as one of the most imperiled ecosystems in the United States (e.g., Noss et al. 1995). Sagebrush shrub habitat is a fairly xeric type with shrubs and grasses co-dominant or shrubs dominant. The vegetation types included, the total number of acres (hectares) in Idaho, and the percentage of Idaho are (from Caicco et al. 1995):

- montane sagebrush and antelope bitterbrush (*Purshia tridentata*) mosaic; 359,071 ac (145,373 ha); 0.7%
- threetip (*Artemisia tripartita*) and mountain big sagebrush (*A. tridentata. vaseyana)* mosaic; 205,531 ac (83,211 ha); 0.4%
- mountain and low sagebrush (*A. arbuscula*) mosaic; 3,298,406 ac (1,335,387 ha); 6.2%
- low and mountain sagebrush mosaic; 334,176 ac (135,294 ha); 0.6%
- low and black sagebrush (*A. nova*) mosaic; 360,822 ac (146,082 ha); 0.7%
- low and fringed sagebrush (*A. frigida*) mosaic; 31,974 ac (12,945 ha); 0.1%
- low and big sagebrush (*A. tridentata*)* mosaic; 1,020,120 ac (413,004 ha); 1.9%
- early low sagebrush; 239,716 ac (97,051 ha); 0.4%
- black sagebrush/western (or Utah) juniper mosaic; 107,314 ac (43,447 ha); 0.2%
- big sagebrush* on lava fields; 546,927 ac (221,428 ha); 1.0%
- big* and low sagebrush mosaic; 5,622,649 ac (2,276,376 ha); 10.5%
- canyon shrub; 291,413 ac (117,981 ha); 0.5%

* big sagebrush is predominantly the Wyoming subspecies, with small amounts of the Great Basin subspecies.

Total area in this habitat is 12,418,120 ac (5,027,579 ha), which is 23% of the state (Caicco et al. 1995). A little over 45% of this type is in the big and low sagebrush mosaic. The next biggest component is the mountain and low sagebrush mosaic (27%). Most of the Sagebrush Shrub habitat type occurs in the southern half of Idaho (Great Basin BCR – BMR-51).

Sagebrush communities have suffered severe degradation and loss, and the future for the remaining sagebrush steppe in particular is bleak. The ecology, natural disturbance patterns, and vegetation communities have been altered by agricultural conversion, invasion of non-native plants, extensive grazing, development, sagebrush eradication programs, and changes in fire regimes (Paige & Ritter 1999). Within the Interior Columbia River Basin, for example, sagebrush and bunchgrass cover types experienced greater losses (30.5% decrease in area) than any other habitat and will probably continue to decline with the cumulative impacts of present land uses (Saab & Rich 1997).

Noss et al. (1995), citing others, reported that 4.9–5.7 million ac (2–2.3 million ha) of sagebrush-grass steppe in the western Snake River basin has been converted to exotic annual vegetation, primarily cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*). Hironaka et al. (1983) reported that more than 99% of the subspecies basin big sagebrush type in the Snake River Plain has been converted to agriculture. Noss et al. (1995) listed the subspecies basin big sagebrush type and ungrazed sagebrush steppe in the Intermountain West as critically endangered ecosystem types in the United States.

Reclaiming degraded sagebrush habitat may not be possible with current technology and funding. What has been lost may be gone forever, making preservation of remaining habitat more crucial. Restoring areas infested with exotic annual grasses is exceedingly difficult. There is no good way to control sprouting of the exotic grasses; viable seed may survive in the soil for many years. New chemical control methods are now being tested, but the technique is still experimental. Even if it were an effective control method, the cost may be prohibitive. Seeds of native grasses and forbs are scarce and very expensive, making it unlikely that large areas could be restored at a time. Germination and survival of native plant seedlings is dependent on precipitation, something that is highly unpredictable in the Intermountain West. Perhaps new developments will make restoration more effective and cheaper in the future. But in the meantime, it is usually more practical and less expensive to protect and improve existing sagebrush habitats.

Large wildfires have recently become a concern in Idaho and much of the west. Fire was probably infrequent in Idaho prior to settlement (Paige & Ritter 1999), especially in the Great Basin sagebrush zone due to the poorly developed grass-forb understory. In the past few decades, fires have increased in frequency in concert with the spread of cheatgrass throughout the region. Managers are concerned about the large-scale loss of sagebrush habitat and, specifically, about the loss of tall stands of sagebrush, which are important for several species and may take as much as 30 years to recover.

In response to these concerns, reseeding programs have been initiated in burned sagebrush areas throughout Idaho. Guidelines for these programs have been generated for Greater Sage-Grouse (Barrett et al. 2000), but effects on other birds are largely unknown and guidelines have yet to be developed. Therefore, resource managers need information on short-term and long-term effects of fire and of post-fire restoration efforts on bird communities. More information is also needed about causes of the long-term declines in shrubsteppe species described above.

Survey Objectives

Information Needed: Estimates are needed of abundance and productivity of sagebrush birds in (1) burned and unburned areas, (2) in restoration projects and untreated areas, and (3) in a variety of untreated sites thought to vary in habitat quality. Abundance is here defined as the mean number of all management species detections in a 10-minute point count in a circle with 100-m radius. A more biologically relevant definition (e.g., density of territorial males and their mates) may be used in future studies. This information can best be obtained by developing a site-based, sagebrush model. See "Products of IBIS and Coordinated Bird Monitoring" and Appendix B for more information about site-based models.

Study Areas: Primarily located throughout southern Idaho in BMR-51. Specific sites will depend on study objectives and always should be coordinated with existing monitoring efforts (see below). Before selecting study areas, we recommend that contacts be made with local resource managers and area biologists to determine the nature and whereabouts of any ongoing work with shrubsteppe birds.

Focal Species: As a result of population declines and subsequent proposals that the species should be protected under the Endangered Species Act, the Greater Sage-Grouse has received recent widespread attention. Sharp-tailed Grouse have also sustained a long-term decline. Declines likely are not restricted to these species, as Great Basin-wide trends for most shrubsteppe obligate species are negative (Knick et al. 2003). Sagebrush habitats in Idaho are used by at least 54 bird species, primarily during the breeding season, 25 of which are management species for this habitat type (Table 8). Several species, including Greater Sage-Grouse, Sage Thrasher, Brewer's Sparrow, and Sage Sparrow are sagebrush obligates and Idaho has a major area responsibility for many of the management species (Carter et al. 2000).

Table 8. List of sagebrush birds of Idaho. Management species for this management issue are in bold.

Turkey Vulture	Gambel's Quail	Common Raven
Northern Harrier	**Long-billed Curlew**	Horned Lark
Swainson's Hawk	Rock Pigeon	**Northern Rough-winged Swallow**
Red-tailed Hawk	Mourning Dove	Cliff Swallow
Ferruginous Hawk	**Burrowing Owl**	**Rock Wren**
Rough-legged Hawk	**Short-eared Owl**	**Mountain Bluebird**
Golden Eagle	Common Nighthawk	Northern Mockingbird
American Kestrel	Common Poorwill	**Sage Thrasher**
Merlin	White-throated Swift	Chipping Sparrow
Peregrine Falcon	Black-chinned Hummingbird	**Brewer's Sparrow**
Prairie Falcon	**Gray Flycatcher**	Lark Sparrow
Chukar	Say's Phoebe	**Black-throated Sparrow**
Gray Partridge	Ash-throated Flycatcher	**Sage Sparrow**
Ring-necked Pheasant	Western Kingbird	**Vesper Sparrow**
Greater Sage-Grouse	Eastern Kingbird	**Lark Bunting**
Sharp-tailed Grouse	**Loggerhead Shrike**	Western Meadowlark
Mountain Quail	Northern Shrike	Brewer's Blackbird
California Quail	Black-billed Magpie	Brown-headed Cowbird

Quantitative Objectives: We suspect that changes in sagebrush bird density resulting from seeding or other treatments may often be modest and therefore suggest that the objective in project evaluations should be 80% power to detect a 2-fold change. We suggest that species-specific models be constructed for single species (the most abundant ones) and for multiple species that include all management species. The single-species models will be useful at a large spatial scale where total abundance will be large. The multi-species model will be more useful in predicting effects of treatments on small areas where only a few individuals of many species of interest may be present. More work is needed on reasonable accuracy targets for these models. Interim targets are CV<0.5 for the species-specific models and CV<0.25 for the multi-species models.

Methods

Bird Survey Methods: The standard point-count survey sampling protocol (Ralph et al. 1993) will be used to estimate relative avian abundance. Demographic work to assess the health and viability of breeding bird communities should include nest searches and nest monitoring. These protocols will primarily be geared toward songbirds since other sagebrush obligates, such as Greater Sage-Grouse, are already well monitored under other IDFG programs (e.g., Connelly et al. 2003).

Sample Size Requirements: To be determined following a more thorough assessment of accuracy targets. Knowing what is an adequate sample size to accurately and reliably assess changes in population trends of shrubsteppe-obligate birds rangewide is of particular interest to the BLM (J. Augsburger, pers. comm.).

Habitat Variables: Habitat variables for the site-based models should include a description of the dominant plant taxa, stand density, and height of (1) grass-forb layer, (2) shrub layer, and (c) sapling and tree layer if one is present (which will be rare). Also, landscape level data should be collected, including presence of cliffs, surrounding habitat types, and patch size, where applicable. Other project-specific variables may also be needed (e.g., burn history, presence of reseeding efforts).

Sampling Plans: Surveys probably should employ one-stage systematic sampling, perhaps preceded by stratification, when project areas are small enough for this to be feasible, and should use multi-stage sampling when the strata are too large for this approach. Precision will generally be higher, for a fixed number of stations, with the first approach. The same general approach will probably work to gather data for development of the site-based predictive model, although in most cases strata will be large enough that clusters of point-count stations will be used. Stratification should be considered to insure that high-quality stands are included in the sampling; habitat assessment may need to precede bird surveys to determine which sites are high quality – collaborative projects with the BLM, IDFG (Idaho Sage Grouse Task Force), IBO, and the IdCDC may prove beneficial in this regard. Analysis should acknowledge the stratification and multi-stage nature of the sampling plan.

Roles and Responsibilities

Existing and Needed Information: Much work regarding shrubsteppe birds has occurred in recent years as a result of increased concerns over habitat loss and degradation throughout the Great Basin BCR. Previous monitoring and research efforts in Idaho are summarized in the IdPIF BCP (Idaho Partners in Flight 2000; http://www.blm.gov/wildlife/plan/pl_id_10.pdf). More recently, Rideout (2001) examined the effects of habitat fragmentation on shrubsteppe birds in southeast Idaho; Sauder (2002) described bird-habitat relationships in the same region. Fragmentation also was studied recently by Schoeberl (2003) in southwest Idaho. Other recently completed work includes an assessment of the effects of fire on breeding bird species composition and abundance in the Boise Foothills by Greg Kaltenecker of IBO. Though that study is now completed, the sites could still be used in the future for monitoring of birds on a local scale like the foothills. IBO now conducts surveys across a network of monitoring sites in BMR-51, primarily looking at habitat relationships of shrubsteppe-obligate birds across a range of habitat conditions. This work is being conducted in conjunction with the BLM to address the broader question of whether Greater Sage-Grouse function as an umbrella species for other shrubsteppe birds. Ongoing rangewide (including Idaho) assessments of sagebrush habitat and associated bird assemblages are being coordinated by Steve Knick at the USGS-Snake River Field Station in Boise (see the SageMap website for more details: http://sagemap.wr.usgs.gov).

Immediate needs are to address the short-term management issue of whether sage-grouse function effectively as umbrella species. This requires that IBIS support ongoing work by IBO, either by providing funding and/or technical assistance with survey work; expanding the monitoring network to include demographic sites would be beneficial. Long-term needs are related to the first management issue discussed in this plan – long-term population trend monitoring of shrubsteppe birds. Again, IBO is a likely project partner to take the lead on this work. Another potential IBIS project would be to document the value to shrubsteppe-obligate passerines of BLM lands *not* currently considered to be sage-grouse strongholds. This information would be of value to the BLM, as would a better understanding of how changes in bird populations are linked to management practices (i.e., documentation of mechanistic, or cause and effect, relationships). One rangewide issue in need of assessment is the effect of fire (both wild and prescribed) on avian communities.

Project Management: With primary project oversight coming from the IBIS steering committee, this issue will be managed through the collaborative efforts of the IDFG Nongame Bird Program, IdPIF, agency biologists, NGOs, and concerned citizens. Cooperative projects with the IdCDC to track birds at high quality sites is recommended.

Recommendations for Implementation

- Decide on final list of habitat variables and how they will be measured for both models
- Obtain habitat variables for existing survey transects
- Summarize existing data from sagebrush communities

- Collaborate with ongoing efforts (e.g., SageMap, IBO's sagebrush surveys for the BLM, Point Reyes Bird Observatory's demographic monitoring network) to provide technical assistance and additional field work
- Use IBIS as a vehicle to secure long-term funding for ongoing shrubsteppe bird monitoring in Idaho

8. Forest Thinning and Fuels Reduction Projects, Especially in Ponderosa Pine Habitats

Background and Description of the Management Issue

In Idaho, dry forest communities are represented by the dry ponderosa pine/Douglas-fir/grand fir potential vegetation group, which incorporates 19 habitat types known to occur within the state. For a more detailed description of the individual habitat types encompassed in this group, refer to Steele et al. (1981) and Cooper et al. (1991). This group of potential vegetation types encompasses those sites that were historically characterized by old-growth ponderosa pine forests but are poorly represented on the landscape today. While the dry ponderosa pine/Douglas-fir/grand fir group is characterized by similar forest conditions under historical disturbance regimes, under current conditions they are very different in both overstory and understory characteristics. Understanding those differences will be important for developing appropriate restoration programs, and assessing the impacts of restoration efforts on existing bird communities.

The dry ponderosa pine/Douglas-fir/grand fir forest group is most commonly associated with the west-central Idaho landscape (Steele et al. 1981), but is also a minor component of the northern Idaho landscape (Cooper et al. 1991). These low elevation forests represent the warm, dry end of the forest environmental gradient. Typically, ponderosa pine types represent the transition zone between the sagebrush/grassland vegetation and forests. In west-central Idaho, ponderosa pine forests may occur as low as 3,000 ft (900 m) in elevation and extend to about 6,500 ft (2,000 m) on steep, dry, southerly aspects.

Current estimates indicate that greater than 75% of the historical old growth ponderosa pine ecosystems have been lost across the Interior Columbia River Basin landscape (USFS & USBLM 1997). Noss et al. (1995) listed old-growth ponderosa pine forests as endangered (85–95% decline) in the northern Rocky Mountains, Intermountain West, and eastside Cascade Mountains. Specific numbers for the loss of this forest group in Idaho are not available at this time. However, it is important to note that the types of dry ponderosa pine forest in Idaho represent a significant component of their worldwide distribution.

The primary effect of past forest management activities on overall acres of ponderosa pine has been the significant change in the historical fire regime. Three types of management activities have had the most influence on changing the historical fire regime: 1) fire exclusion policies; 2) grazing of livestock; and 3) harvesting of trees (Covington & Moore 1994).

The most common result of fire exclusion in these forests has been the development of an increasingly homogeneous landscape characterized by large, stand-replacing fire regimes. For nearly 100 years, the combined influence of fire exclusion and grazing has altered the forest structure and species composition of this forest group in Idaho (Crane & Fischer 1986). Since the early 1900s, efforts to exclude fire, among other influences, have lengthened the fire return interval in these forests. Today, forests of the dry ponderosa pine/Douglas-fir/grand fir group no longer exhibit conditions that would support a low intensity understory fire. Many of these forests have not burned since the 1800s and contain a considerable amount of fuel in the understory. The Douglas-fir and grand fir potential vegetation types have progressed to a late successional condition of Douglas-fir and Douglas-fir/grand fir, respectively

(Steele 1994). All potential vegetation types are experiencing tree densities far outside the historical range of conditions for these sites (Covington & Moore 1994, Sloan 1998*a* and *b*), with different species composition. Dense understory conditions provide a "ladder" for fire to reach the overstory, which in turn increases the severity of the fire. Intense, stand-replacing fires are abnormal disturbance events in this forest group and have resulted in severe modifications of the historical forest ecosystem and to biodiversity. Prior to 1900, the high fuel conditions typical of today's forest were limited to forests growing in and around protective topographic features such as north aspects, moist draws, and canyon bottoms.

Grazing impacts began in the late 1800s and early 1900s when enormous herds of domestic sheep and cattle were allowed to graze freely throughout these low elevation forests. The result was substantial damage to soils and vegetation, especially where herds were concentrated. Perennial bunchgrasses, in particular, are still recovering from the severe overgrazing of the early days (Steele et al. 1981). This level of grazing also functioned to suppress fires by reducing the continuity of the understory vegetation and preventing low intensity fires from spreading in their normal pattern across the landscape (Covington & Moore 1994). Today, grazing continues but at much lower densities. Localized damage to vegetation and soils may still occur where animals concentrate, particularly in riparian areas and forest openings. Similarly, grazing still appears to affect the forest ecology of these sites in terms of forest structure and species composition. Specific observed influences on forest structure are increased tree numbers, decreased native grasses, increased accumulation of downed woody material, increased spread of exotic and noxious weeds, and increased forest floor duff. These influences, in combination with fire suppression, enhance conditions for high intensity, stand-replacing fires and reduce conditions that would support the low intensity fires that historically occurred in these forests (Zimmerman & Neuenschwander 1984).

The effects of timber harvest on this forest group have changed over the years. Early timber harvests usually targeted the largest trees, which in most instances were ponderosa pine, and to a much lesser extent Douglas-fir and western larch. This form of harvest, coupled with fire suppression, has allowed smaller, shade-tolerant, late-successional species such as Douglas-fir to capture the growing space (Sampson et al. 1994). The result has been a rapid shift on many sites from forests dominated by seral species to forests dominated by late successional species, and from open stands of old growth trees to dense stands of young trees. This changes the habitat available to birds associated with the open stands found under a historical understory fire regime. More recently, timber management programs have used more intensive harvest practices such as clearcutting. Clearcut areas tend to recover slowly from logging disturbance and efforts to reforest clearcuts have been, on average, less than successful (Steele et al. 1981). Today, selective harvest with natural regeneration is considered the more ecologically responsible harvest method in these forests. Although fire exclusion, grazing, and timber harvest, alone or in combination, have resulted in and continue to cause the loss of the old-growth ponderosa pine forests, the most immediate threats to the future viability of these forests are stand-replacing fire occurrences and within-stand dynamics.

Very little area representing historical old-growth ponderosa pine forest conditions, where old-growth is generally defined as trees older than 200 years, remains today (Hamilton 1993). Many stands still contain old-growth ponderosa pine; however, tree densities and fuel accumulations present a significant risk to their long-term survival and future restoration. Lightning-caused and accidental fires have the potential to burn with unprecedented and uncontrollable intensity and magnitude. Allowing these forests to burn under a stand-replacing fire regime to "reset the balance" is not a viable alternative for restoration of these forests (Steele 1994). The remaining old-growth ponderosa pine would be lost from the landscape and cannot be replaced for more than 200 years. With each stand-replacing fire in these low elevation forests, restoration options are lost. To complicate things further, the intensity of stand-replacing fires on these sites often damages the soil or allows understory species better adapted to intense fire regimes to take hold. The result is generally delayed recolonization by all species where the soil is damaged, or recolonization by shrubs that outcompete seral tree species and prevent or delay their

establishment for many years to come. The impact is the same, however, with the extended loss of the old growth ponderosa pine ecosystem from the landscape.

Within dry forests, managers seek to restore open, park-like stands of mature ponderosa pine using a combination of prescribed burning and selective vegetation management (Covington et al. 1999). Returning this habitat to a more historical condition likely will benefit several high priority bird species, such as the White-headed Woodpecker, White-breasted Nuthatch, and Flammulated Owl. Other species that regularly use pine for nesting and foraging include Hammond's Flycatcher, Chipping Sparrow, and Pygmy Nuthatch. Restoration efforts in this forest group must target saving any existing old-growth or large ponderosa pines where they occur and improving survival and growth rates of ponderosa pine where they can reestablish. Whereas restoration efforts are complicated and will not be addressed in detail here, restoration should primarily consist of reducing the density of trees in many stands by removing small trees, and reintroducing fire where possible. For this habitat, gentle slopes with remnant large ponderosa pine are almost nonexistent, but such sites serve as potential locations for primary restoration efforts. We caution that most areas with large ponderosa pine are currently on very steep slopes and/or are in inaccessible areas and are therefore not suitable for primary restoration efforts.

Kay (1995) concludes that, historically, Native Americans commonly determined the structure of entire plant and animal communities by hunting and by setting fires (also see papers cited in Knowles & Knowles 1993), and that a current "natural regulation" approach to management does not recognize and thus probably would not replicate such historical conditions (Marcot et al. 1998). Perhaps with careful thinning and logging of many lower elevation forests, along with prudent reintroduction of fire into these ecosystems, old- growth ponderosa pine forests eventually can be encouraged to return.

Survey Objectives

Information Needed: Although project evaluations should, at a minimum, document breeding abundance of management species, management species abundance throughout the year and measures of fitness, including productivity during the breeding season and foraging success during migration, also would be highly desirable. Information on prescribed burning is especially needed, including an evaluation of spring burning to assess potential direct mortality on early-nesting birds.

A site-based model should predict management species abundance relative to a continuum in habitat conditions influenced by fire, grazing, and restoration treatments. Models should be generated for both breeding and migration. As projects are implemented, short-term trends in abundance also may be of interest, particularly in large projects. In particular, assessments of how closely "fuels reduction" treatments truly constitute "restoration" of ponderosa pine are needed; monitoring the composition of forest avifauna to evaluate if treatments ultimately result in desired changes in bird species' composition and abundance is essential.

Study Areas: Could be anywhere in Idaho where thinning and/or fuels reduction treatments are being conducted; emphasis should be on dry forest types where possible, especially management actions considered to be restoration of ponderosa pine. Stands of old-growth ponderosa pine have recently been mapped by Mehl and Haufler (2003) for the entire state and their potential for restoration evaluated. Clusters of stands were identified and provide a logical starting place with which to address this management issue. Other study areas should also be used as opportunities for collaborative projects arise (e.g., at Craig Mountain WMA). Coordination with USFS and timber industry biologists and managers to identify potential study sites where future treatments are planned is critical.

Focal Species: Ponderosa Pine habitats are used by at least 31 bird species; 4 of which are Idaho species of special concern including Flammulated Owl, Northern Pygmy-Owl, Lewis's Woodpecker, and White-headed Woodpecker (Table 9, Appendix A).

Table 9. List of ponderosa pine birds of Idaho. Management species for this management issue are in bold.

Merlin	**Black-backed Woodpecker**	**Red-breasted Nuthatch**
Wild Turkey	Northern Flicker	White-breasted Nuthatch
Mountain Quail	Pileated Woodpecker	**Pygmy Nuthatch**
Flammulated Owl	Western Wood-Pewee	Brown Creeper
Great Horned Owl	**Cassin's Vireo**	Hermit Thrush
Northern Pygmy-Owl	Steller's Jay	Nashville Warbler
Rufous Hummingbird	**Clark's Nutcracker**	**Western Tanager**
Lewis's Woodpecker	Common Raven	House Finch
Downy Woodpecker	Black-capped Chickadee	Pine Siskin
Hairy Woodpecker	**Mountain Chickadee**	
White-headed Woodpecker	Chestnut-backed Chickadee	

Quantitative Objectives: Although species-specific estimates of abundance are desirable, they often cannot be obtained with sufficient precision to be useful. As an alternative, we define the primary parameter of interest as the mean number of individuals of all forest management species recorded with a large sample.

The desired accuracy of models to predict abundance, should a proposed project be implemented, must be established independently of specific projects. More experience is needed in developing these models for forest habitats in Idaho, but we believe that a reasonable initial target is that the CV of the predicted abundance for a single project area should be ≤ 0.25.

Because projects affecting forest habitat often cause major changes in stand structure and species composition, and therefore bird abundance, surveys can be designed to detect large, rather than small, changes. As an approximate guideline, it seems reasonable that power to detect a 2–3 - fold change should be at least 80%. Whereas detecting a 2-fold change (lower precision than 3-fold) may be appropriate for smaller projects, detecting a 3-fold change may be more appropriate for larger projects.

Methods

Bird Survey Methods: The standard point-count survey sampling protocol (Ralph et al. 1993) will be used to estimate relative avian abundance. Demographic work to assess the health and viability of breeding bird communities should include nest searches and nest monitoring. These protocols will primarily be geared toward songbirds although more specific techniques developed for nocturnal species (forest owls and nightjars) and cavity nesters (woodpeckers) also are encouraged. Standardized guidelines have recently been adopted for nocturnal owl monitoring in North America (Takats et al. 2001) and are the method of choice for owls surveys conducted under the IBIS framework; for a copy of the protocols and more detailed information, visit http://www.bsc-eoc.org/regional/owlguide.html.

Sample Size Requirements: To be determined following a more thorough assessment of accuracy targets.

Habitat Variables: Habitat variables for the regional model should include stand size and elevation, and may also include measures from geo-referenced data sources, such as soil type, slope, and aspect. Habitat variables for the site-based model should include measures of dominant plant taxa, stand density, and height of (1) grass-forbs, (2) shrubs and saplings, (3) understory trees, and (4) overstory trees. Average diameter-at-breast-height of overstory trees, canopy cover, volume of down and standing

(snags) dead wood, species composition, and plant association (forest habitat type) should also be assessed.

Sampling Plans: Project evaluation surveys probably should employ one-stage systematic sampling, perhaps preceded by stratification, when project areas are small enough for this to be feasible, and should use multi-stage sampling when the strata are too large for this approach. Precision will generally be higher, for a fixed number of stations, with the first approach. The same general approach will probably work to gather data for development of the site-based predictive model, although in most cases strata will be large enough that clusters of point-count stations will be used. Strata should be delineated to insure that a wide range of habitat types is included. Analysis should acknowledge the stratification and multi-stage nature of the sampling plan.

Mehl and Haufler (2003) could be used to locate high quality sites with high restoration potential. Where sampling is intended to be more extensive, a combination of road-side and off-road counts would probably be most effective. In BMR-51 (i.e., USFS Region 4 in Idaho), establishing a network of forest transect routes similar to that of the Northern Region Landbird Monitoring Program (NRLMP) (http://biology.umt.edu/landbird/mbcp/perspectives.htm) is desirable. These could initially follow existing USFS survey routes for Management Indicator Species (MIS) whereby birds other than woodpeckers (i.e., owls and songbirds) could be surveyed at the same points but at different times of the season.

Roles and Responsibilities

Existing and Needed Surveys: Current surveys include woodpecker response to fall prescribed burning on the Payette National Forest, and woodpecker response to wildfire on the Boise National Forest by Vicki Saab (USFS Rocky Mountain Research Station). Previous research on songbirds has focused primarily on describing habitat relationships, response to thinning treatments, landscape fragmentation (R. Sallabanks, unpubl. data). Northern goshawk monitoring continues to occur on the Sawtooth and Caribou-Targhee National Forests in BMR-51, but also on private timberlands operated by Potlatch Corporation in BMR-50. Also in the north, the NRLMP has been in place for a decade. Earlier species-specific work includes assessments for great gray, boreal, and flammulated owls on several national forests throughout the state.

Surveys specifically designed to address this management issue are however lacking. What is needed are more coordinated standardized surveys across broad geographic landscapes designed to address the same management issue. A network of sites that would allow data to be pooled for "meta-analysis" is desirable; information on the demographic responses of songbirds to thinning and fuels reduction treatments are especially needed.

Project Management: Design of coordinated forest bird surveys should be administered by an IBIS monitoring sub-committee comprised of agency biologists and managers with expertise and interest in this management issue. Existing members of the IdPIF Pine Task Force would be an ideal group to assume leadership on setting project objectives, building collaborative partnerships, and serving as an "advisory board" for overall project direction.

Recommendations for Implementation

Coordinate with existing work to effectively fill gaps and void redundancy
Look for opportunities to collect pre-treatment data where future projects are being planned

- Continue to work with USFS biologists and regional program leaders to establish a coordinated network of monitoring sites in BMR-51
- Initiate surveys for nocturnal species in 2004–2005 where possible; test protocols and communicate results to others

- Engage IdPIF Pine Task Force to help with project oversight and identify monitoring opportunities

9. Effects of Management in Pinyon-Juniper Habitats

Background and Description of the Management Issue

Juniper and Pinyon Woodlands include western (*Juniperus occidentalis*), Utah (*Juniperus osteosperma*), and Rocky Mountain (*Juniperus scopulorum*) juniper, and singleleaf pinyon (*Pinus monophylla*) woodlands, with some of these species being co-dominant with others. The singleleaf pinyon is co-dominant with curl-leaf mountain mahogany (*Cercocarpus ledifolius*) or Utah juniper (Rust 1999). Pinyon-juniper and juniper woodland vegetation occurs at the northern extent of its range in Idaho (Cronquist et al. 1972). Western juniper in Idaho occurs in the Owyhee Plateau of the southwest corner. About six percent of the total area in the West covered by western juniper occurs in Idaho. Utah juniper-dominated woodlands in Idaho occur in the South Hills, east to the Malad and Bannock ranges, and north across the Snake River Plain to the southern end of the Lost River and Lemhi ranges (Rust 1999). Upland Rocky Mountain juniper-dominated woodlands occur on the Wapi Flow within the Snake River Plain, south on lower-slope positions in the Goose Creek drainage, east on the lower-and upper-slope positions in the Bannock, Portneuf, and Bear River Ranges, and on basalt flows of the Portneuf River valley of southeastern Idaho (Rust 1999). Singleleaf pinyon occurs in the Albion, Jim Sage, and Black Pine Mountains of the center part of southern Idaho. The most land-locked singleleaf pinyon are in southern Idaho, where they form woodlands with Utah juniper at several locations, including City of Rocks (Lanner 1975).

During the past 150 years, western juniper has expanded its range into adjacent grasslands and shrublands (Burkhardt and Tisdale 1976), and aspen and riparian areas (Hann et al. 1997). All of these other types are priority habitats for birds; they have all decreased in quantity and quality from historic times (Hann et al. 1997), and expansion of junipers into these types is an important issue. Much of the Utah juniper in southern Idaho is relatively young (<120 years), having become established after about 1880, based on recent studies (P. Makela, pers. comm.). The post-settlement increase of juniper came about at least partly due to a reduction in fine fuels as a result of heavy livestock grazing near the turn of the century. Lack of fine fuels hinders the spread of wildfires (U.S. Bureau of Land Management 1991). Current conditions of juniper dominance have been maintained in many areas due to aggressive wildfire suppression (P. Makela, pers. comm.). Lack of wildfire also has allowed young junipers to fill in the interspaces within old-growth stands, resulting in a closer canopy than probably occurred pre-European settlement. This likely has reduced the quality of oldgrowth habitat for old-growth dependent species. West et al. (1998) state, "We are currently dealing with a vastly greater amount of juniper and pinyon-dominated lands than any humans have encountered over the last 5,000 years."

Managers have requested guidance on how bird conservation strategies might be included in pinyon-juniper management, especially for the use of prescribed fire and other methods of tree removal used for preserving sagebrush habitats and for managing stand susceptibility to wildfires. Information also is needed to help identify high-quality stands (e.g., that agencies would try to protect during a wildfire) and to evaluate bird responses to management programs such as thinning or partial removal of a stand. Effects of landscape mosaics will be particularly valuable, since it is assumed that birds associated with pinyon-juniper respond to fires at a landscape scale. For example, managers intending to remove part of a large stand need to know whether the remainder of the stand, and other stands nearby, will continue to provide adequate habitat for birds. Guidelines for managers, along with species accounts for pinyon-juniper birds of conservation concern, have recently been developed by Gillihan (2004).

Survey Objectives

Information Needed: Models are needed to predict abundance and productivity of birds in pinyon-juniper during the breeding season, as well as abundance and fitness of birds in pinyon-juniper during migration. Abundance is here defined as the mean number of birds of all management species detected in a 10-minute point count in a circle with 50-m radius. A more biologically relevant definition (e.g., density of territorial males and their mates) may be used in future studies. Surveys also are needed that will allow for long-term population trend monitoring of pinyon-juniper birds, better information on bird-habitat relationships, and baseline data on avian community composition. To begin to meet these needs, the IdCDC is planning to initiate a project in the South Hills and City of Rocks National Monument (Cassia Co.) of southern Idaho in 2004.

Study Areas: Initial work should focus on areas of Utah Juniper and mixed Utah Juniper-Pinyon Pine in southern Idaho. Baseline data on birds in relatively pristine habitats (i.e., old-growth pinyon-juniper) are recommended, especially in areas where Utah Juniper occurs within its natural range.

Focal Species: Pinyon-juniper habitats in Idaho are used by at least 56 bird species including 15 management species (Table 10).

Table 10. List of pinyon-juniper birds of Idaho. Management species for this management issue are in bold.

Turkey Vulture	**Pinyon Jay**	Orange-crowned Warbler
Cooper's Hawk	Clark's Nutcracker	**Virginia's Warbler**
Red-tailed Hawk	Black-billed Magpie	Black-throated Gray Warbler
Ferruginous Hawk	Common Raven	Yellow-breasted Chat
Mourning Dove	Juniper Titmouse	**Western Tanager**
Great-horned Owl	Black-capped Chickadee	**Green-tailed Towhee**
Common Nighthawk	**Mountain Chickadee**	Spotted Towhee
Common Poorwill	Bushtit	Chipping Sparrow
Red-naped Sapsucker	Rock Wren	**Brewer's Sparrow**
Hairy Woodpecker	Canyon Wren	**Vesper Sparrow**
Northern Flicker	Ruby-crowned Kinglet	Lark Sparrow
Gray Flycatcher	Golden-crowned Kinglet	**Black-throated Sparrow**
Cordilleran Flycatcher	Blue-gray Gnatcatcher	Dark-eyed Junco
Ash-throated Flycatcher	**Mountain Bluebird**	**Lazuli Bunting**
Loggerhead Shrike	Western Bluebird	Brown-headed Cowbird
Northern Shrike	**Townsend's Solitaire**	Scott's Oriole
Plumbeous Vireo	American Robin	Pine Siskin
Steller's Jay	Sage Thrasher	**Cassin's Finch**
Western Scrub-Jay	Cedar Waxwing	

Quantitative Objectives: Both statewide (regional) and site-based models are needed. The statewide model will permit a regional evaluation of the importance of pinyon-juniper habitats to birds, as well as identification of large-scale patterns in pinyon-juniper use. The site-based model will help elucidate which traits of pinyon-juniper stands (including landscape variables) are most highly correlated with bird abundance. See "Products of IBIS and Coordinated Bird Monitoring" and Appendix B for more information about statewide and site-based models. We suggest that species-specific and multi-species

versions of each model be constructed. More work is needed on reasonable accuracy targets for these models. Interim targets are CV<0.5 for the species-specific models and CV<0.25 for the multi-species models.

Methods

Bird Survey Methods: The standard point-count survey sampling protocol (Ralph et al. 1993) will be used to estimate relative avian abundance. Transects should be off-road where possible and permanently marked for relocation in future years to allow for long-term trend monitoring.

Sample Size Requirements: To be determined following a more thorough assessment of accuracy targets. Preliminary data collected by the IdCDC in 2004 can be used to make these assessments and estimate necessary sample sizes for future work.

Habitat Variables: Habitat variables for the regional model should include stand size and elevation, and may also include measures from geo-referenced data sources, such as soil type, slope, and aspect. Habitat variables for the site-based model should include dominant plant taxa, canopy coverage, and height of (a) grass-forbs, (b) shrubs and saplings, (c) understory trees, and (d) overstory trees. Average diameter-at-breast-height of overstory trees should also be recorded. Landscape variables may be generated from available supporting data, such as recent aerial photography or vegetation maps that provide data on surrounding habitat types. Burn history, prescribed fire treatments, or other fire prevention treatments, need to be included as well. These will likely be available from the BLM and Forest Service as geo-referenced maps. Vegetation plots to characterize community stand structure will be developed by the IdCDC in 2004 and could serve as a model for assessments made elsewhere.

Sampling Plans: Project evaluation surveys probably should employ one-stage systematic sampling, perhaps preceded by stratification, when project areas are small enough for this to be feasible, and should use multi-stage sampling when the strata are too large for this approach. Precision will generally be higher, for a fixed number of stations, with the first approach. The same general approach will probably work to gather data for development of the site-based predictive model, although in most cases strata will be large enough that clusters of point-count stations will be used. Strata should be delineated to insure that a wide range of habitat types is included. Analysis should acknowledge the stratification and multi-stage nature of the sampling plan.

Roles and Responsibilities

Existing and Needed Surveys: Few data exist on pinyon-juniper bird communities in Idaho. In recent years (2003–2004), M. Austin (unpubl. data) has conducted two seasons of breeding bird surveys in pinyon-juniper habitats of southeast Idaho. Although focusing on documenting locations of two focal species, Virginia's Warbler and Pinyon Jay, Austin collected data on all birds seen or heard during census periods. Six permanent point-count transects and their monument routes were developed, and three repeat visits were performed for each route in 2003; plans are to repeat counts again in 2004. All transects were mapped using GPS coordinates for relocation in subsequent years. In part as an extension of this work, the IdCDC will initiate bird surveys in pinyon-juniper in 2004 (see above). Following collection of baseline data, threats to critical pinyon-juniper habitat should be evaluated with short-term assessments of specific management issues. Demographic data to document population viability in a range of habitat conditions (to begin to address the question of what constitutes high quality habitat) are encouraged in subsequent years.

Project Management: With primary project oversight coming from the IBIS steering committee, this issue will be managed through the collaborative efforts of the IDFG Nongame Bird Program, IdPIF, agency biologists, NGOs, and concerned citizens. Cooperative projects with the IdCDC to track birds at high

quality sites is recommended; the IdCDC's new pinyon-juniper bird-habitat study will be closely coordinated with IBIS.

Recommendations for Implementation

- Coordinate with other investigators who have assessed pinyon-juniper birds and their habitats to determine which additional information is still needed
- Decide on a final list of habitat variables and how they will be measured for both models
- Obtain these habitat variables for existing survey transects
- Coordinate bird monitoring efforts with habitat assessments made by IdCDC
- Build on existing surveys by adding more permanent transects for long-term population monitoring
- Identify priority areas, management issues, and target bird species for future work

Summary of Recommendations

The purpose of CBM plans, such as IBIS, is to network existing surveys with each other, to identify important gaps, and to cover these gaps using scientifically-sound methods. One desired result of CBM is that projects that are part of the network will have already undergone significant scientific scrutiny through a peer-review process by the time they may be challenged. Another desired outcome is that access by resource managers to relevant bird data will be improved, thus allowing them to efficiently use limited funds for inventory and monitoring. Such access to data (or metadata) will ultimately be provided through data repositories within Idaho (i.e., IdCDC) and at national data banks (i.e., Patuxent Wildlife Research Center). In addition, dissemination of results from analyses of monitoring data can occur quickly to Idaho partners through the IDFG Nongame Bird Program.

As a first step toward implementing IBIS, we recommend completing the assessment of ongoing monitoring efforts that may be included in a statewide network. Specifically, we ask our partners to review the list of existing surveys (see "Summary of Existing Bird Monitoring and Assessment Projects in Idaho" section above) to determine if all surveys are appropriately listed. For this, we emphasize efforts that are either already designed for longer-term monitoring (>4 years) or that should be made part of a longer-term effort, and efforts that are relevant to a short-term objective (management issue) of this document. Most research projects will likely fall outside the purview of CBM and IBIS; we recommend including only those that address a short-term objective named in this draft document (e.g., site inventories that use standardized methods, habitat-quality studies for single species, etc.).

Secondly, preliminary bird and habitat data already exist for all management issues discussed in this document. We thus recommend completing preliminary analyses on these data sets to: (1) determine how much more sampling needs to be done to adequately address the issues raised; and (2) provide preliminary results from regional and site-based models on those management issues where somewhat comprehensive data sets are already available.

Finally, we recommend implementing the short set of actions listed under each of the management issues (see above) to move forward on each of the short-term goals of the program.

Implementation Steps and Timetable

- Spring 2004
  - ✓ Hire IBIS Coordinator and assistant wildlife technician
  - ✓ Secure funding for initial (3 year) implementation phase
  - ✓ Complete first draft of IBIS (v1.0) and submit for review to Great Basin Bird Observatory, USGS, and the IdPIF Steering Committee
- Summer 2004
  - ✓ Begin testing phase of aquatic site descriptions and survey protocols at a subset (3-5) of sites
  - ✓ The IBIS Coordinator will attempt to visit each discrete aquatic site proposed in the plan to verify information in site descriptions, and amend as needed
- Fall 2004
  - ✓ Revise IBIS according to results of trial field season, as well as expand IBIS to include survey goals and methods for terrestrial sites and species
  - ✓ Identify parties interested in assisting with monitoring at aquatic sites proposed by IBIS
- Winter 2004
  - ✓ Complete IBIS plan (v2.0 – all-bird)
  - ✓ Prepare for expanded 2005 field season

Proposed Action Plan

To implement IBIS, we propose a division-in-labor approach that shares the burden of implementation among the program partners. To facilitate further discussion of the implementation process, we provide here a preliminary list of both long-term (Table 11A) and short-term (Table 11B) program elements, the lead agency/organization for each element, potential funding mechanisms, and current status of element implementation. Note: IBIS partners are asked to fill in and modify these tables during their review of the draft monitoring plan, v1.0.

Coordination between the plan elements will need to be centralized, and we recommend that this is done through IDFG. The role of IDFG would be to provide a data network that accommodates queries from partners, to help partners identify gaps in monitoring coverage, and where possible, provide additional labor to implement the monitoring work. IBIS is not intended to create more work for existing IDFG biologists unless they are given the appropriate authority and have the time and desire to become involved themselves. Rather, monitoring activities by IDFG will be accomplished through the hiring of temporary wildlife technicians on a seasonal basis. These staff will be supervised by the IBIS Coordinator and are likely to be regionally-based, being responsible for monitoring activities throughout geographically distinct portions of the state. Technical oversight on IDFG's work will be provided through Idaho's All-Bird Working Group, the IBIS steering committee, and the USGS – Snake River Field Station through the formal peer-review process involved in scientific publications.

Table 11A. Summary of IBIS plan elements, agency/organization responsibilities, funding mechanisms, and current status of implementation: long-term monitoring elements.

IBIS Plan Element	Responsible Agency/Organization	Funding Mechanism(s)	Current Status of Implementation
Waterbird Monitoring	IDFG, USFWS, Audubon, volunteers, Teton Regional Land Trust (TRLT), The Nature Conservancy (TNC)	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), federal funds, in-kind contributions	Miscellaneous efforts at NWRs and WMAs; improved coverage anticipated with IBIS v1.0.
Colony Counts	IDFG, USFWS, Audubon, volunteers	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), in-kind contributions	Miscellaneous efforts in BMR-51; improved coverage anticipated with IBIS v1.0.
Shorebird Monitoring	IDFG, USFWS, USGS – Snake River Field Station, Audubon, volunteers	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), federal funds, in-kind contributions	Negligible in past; improved coverage anticipated with IBIS v1.0.
Waterfowl Monitoring	IDFG, USFWS	State and federal funds, hunting licenses	Conducted annually since 1950; continue without changes.
Upland Gamebird Monitoring	IDFG, BLM	State and federal funds, hunting licenses	Conducted annually since 1950; continue without changes.
Landbird Monitoring	IDFG, USFS, BLM, USGS – Snake River Field Station, Potlatch Corporation	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), Challenge Cost Share Agreements, private industry funds	BBS and USFS Northern Region Landbird Monitoring Programs well-established; additional BBS routes and USFS monitoring in BMR-51 anticipated with IBIS v2.0.
Shrubsteppe Bird Monitoring	Idaho Bird Observatory, USGS – Snake River Field Station, BLM	Challenge Cost Share Agreements, federal funds	Existing surveys conducted by IBO anticipated to be expanded with IBIS v2.0.
Nocturnal Bird Monitoring	IDFG, USFS, Idaho Bird Observatory, Potlatch Corporation, Boise State University	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), Challenge Cost Share Agreements, private industry funds, in-kind contributions	Miscellaneous efforts statewide conducted sporadically in the past. Pilot surveys implemented in 2004 at select locations; significant expansion anticipated with IBIS v2.0.
Breeding Raptor Monitoring	Idaho Bird Observatory, Potlatch Corporation, IDFG, USGS – Snake River Field Station, Idaho Power	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), private industry, federal funds	Conducted annually for approximately previous decade; may need to be expanded as time and resources allow.
Winter Raptor Monitoring	IDFG, BLM, USFS, USGS – Snake River Field Station, Boise State University, Idaho Power	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), private industry, federal funds	Conducted annually since 1979; continue without changes.
Migrant Raptor Monitoring	Idaho Bird Observatory, Boise State University, Audubon, volunteers	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), federal funds, non-governmental, in-kind contributions	Conducted annually for approximately previous decade; may need to be expanded as time and resources allow.
Migrant Songbird Monitoring	Idaho Bird Observatory, Boise State University, Audubon, volunteers	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), federal funds, non-governmental, in-kind contributions	Conducted annually for approximately previous 5 years; may need to be expanded as time and resources allow.
Black Swift Surveys	IDFG, Audubon, volunteers	Nongame Wildlife Program (IDFG), in-kind contributions	None prior to 2004; improved coverage with IBIS v2.0.
Harlequin Duck Surveys	IDFG, USFS	Nongame Wildlife Program (IDFG), federal funds	Conducted annually since 1987; additional surveys are needed in new areas in future years.
Bald Eagle Territory Monitoring	IDFG, USFS, BLM, TRLT	Nongame Wildlife Program (IDFG), federal funds, non-governmental, in-kind contributions	Conducted annually since 1979; continue without changes.
Peregrine Falcon Territory Monitoring	IDFG, USFS	Nongame Wildlife Program (IDFG), federal funds	Conducted annually since 1985; continue without changes.

Table 11B. Summary of IBIS plan elements, agency/organization responsibilities, funding mechanisms, and current status of implementation: short-term monitoring elements.

IBIS Plan Element	Responsible Agency/Organization	Funding Mechanism(s)	Current Status of Implementation
Inventory of IDFG Wildlife Management Areas (WMAs) for birds in all seasons	IDFG	Nongame Wildlife Program (IDFG) and State Wildlife Grants (USFWS)	Existing inventories vary by WMA, including both completeness (i.e., information on all species) and how recently they were conducted. Pilot work under IBIS v1.0 initiated in 2004; significant improvements anticipated in future years.
Effects of wetland loss and degradation	IDFG, USFWS, BLM, USFS, private industry, non-governmental organizations (e.g., TNC, DU, TRLT)	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), federal funds, Challenge Cost Share Agreements, private industry	Idaho's waterbirds (and shorebirds) have not been previously monitored in any sort of statewide, coordinated manner. This element is one of the highest priorities for implementation with IBIS v1.0.
Conflicts between piscivorous birds and fish populations	IDFG, USFWS, Audubon, volunteers	Nongame Wildlife and Fisheries Programs (IDFG), State Wildlife Grants (USFWS), federal funds, in-kind contributions	There have been no comprehensive studies to document the impact of piscivorous birds on Idaho's fisheries. Some ongoing work at Blackfoot Reservoir involves cormorants and pelicans. Additional information is needed.
Effects of altering riparian habitats	IDFG, BLM, USFS, private industry, TNC, DU	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), federal funds, Challenge Cost Share Agreements, private industry	Few examples of long-term monitoring of riparian birds in Idaho exist. Studies have been conducted sporadically, especially in eastern Idaho. Improved coverage anticipated with IBIS v2.0.
Condition of aspen habitat and importance for birds	IDFG, BLM, USFS, private industry	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), federal funds, Challenge Cost Share Agreements, private industry	Few data exist on relationships between the condition of aspen stands and bird communities in Idaho. Basic descriptions of aspen bird community composition, relative abundance of species, and stand condition are anticipated with IBIS v2.0 in the near future.
Identification of high quality habitat and effects of land-use practices in sagebrush communities	IDFG, BLM, USGS – Snake River Field Station, Idaho Bird Observatory	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), Challenge Cost Share Agreements, federal funds	Immediate needs are to address the short-term management issue of whether sage-grouse function effectively as umbrella species. This requires that IBIS support ongoing work by IBO, either by providing funding and/or technical assistance with survey work.
Forest thinning and fuels reduction projects, especially in Ponderosa Pine habitats	USFS, Potlatch Corporation, IDFG, IdPIF Pine Task Force	Federal funds, National Forest Foundation, private industry, Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS)	Surveys specifically designed to address this management issue are lacking. A network of sites that would allow data to be pooled for "meta-analysis" is desirable; IBIS v2.0 will provide a framework under which this could be achieved.
Effects of management in Pinyon-Juniper habitats	IDFG, USFS, BLM, Red Willow Research (RWR)	Nongame Wildlife Program (IDFG), State Wildlife Grants (USFWS), Challenge Cost Share Agreements, in-kind contributions	Few data exist on pinyon-juniper bird communities in Idaho. RWR conducted two seasons of breeding bird surveys in southeastern Idaho in 2003–2004. IdCDC also will initiate bird surveys in 2004 in south-central Idaho. IBIS v2.0 will outline protocols to support these efforts, although proposed future monitoring under IBIS is limited.

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Appendix A. Avian Species in Idaho that Warrant Monitoring

Listed are all avian species that regularly occur in Idaho during at least one season

Classification Levels (according to BCR assessment scores adjusted for Idaho by IdPIF):

1 – Highest Priority
2 – Moderate Priority
3 – Low Priority
4 – No Priority
NB – Non-breeder

Management Issues:

a = Aspen Habitat Condition
f = Bird-fish Conflicts
j = Pinyon-juniper Management
p = Forest Thinning, Particularly in Ponderosa Pine
r = Riparian Alteration
s = Sagebrush Fires and Post-fire Restoration
w = Wetland Loss and Degradation

Survey Techniques:

1 = BBS & Similar Point Count Surveys
2 = Area Searches for Landbirds
3 = Area Searches for Waterbirds
4 = Migration Monitoring Programs
5 = Nest Success Programs
6 = Colony Counts
7 = Aerial Surveys
8 = Nocturnal Surveys
9 = Upland Gamebird Surveys
10 = Other Surveys

Species:	Initiative	Classification Level: BCR-9	BCR-10	Season(s) of occurrence	Mgmt Issue	Survey Techn.
Red-throated Loon - *Gavia stellata*	Waterbird	NB	NB	M	w,f	3
Pacific Loon - *Gavia pacifica*	Waterbird	NB	NB	M	w,f	3
Common Loon -*Gavia immer*	Waterbird		2	BMW	w,f	3,5,7
Pied-billed Grebe - *Podilymbus podiceps*	Waterbird	4	3	BW	w,f	3,5
Horned Grebe - *Podiceps auritus*	Waterbird		4	BMW	w,f	3,5,7
Red-necked Grebe - *Podiceps grisegena*	Waterbird		3	BW	w,f	3,5,7
Eared Grebe - *Podiceps nigricollis*	Waterbird	2	4	BMW	w,f	3,5
Western Grebe - *Aechmophorus occidentalis*	Waterbird	3	3	BW	w,f	3,5,7
Clark's Grebe - *Aechmophorus clarkii*	Waterbird	3	3	BW	w,f	3,5,7
American White Pelican - *Pelecanus erythrorhynchos*	Waterbird	2	2	BMW	w,f	5,6,7
Double-crested Cormorant - *Phalacrocorax auritus*	Waterbird	4	4	BMW	w,f	3,5,6
American Bittern - *Botaurus lentiginosus*	Waterbird	3	3	B	w,f	1,3,5
Great Blue Heron - *Ardea herodias*	Waterbird	4	4	BW	r,w,f	3,5,6
Great Egret - *Ardea alba* **	Waterbird	2	NB	BW	r,w,f	3,5,6
Snowy Egret - *Egretta thula* **	Waterbird	4	4	BM	r,w,f	3,5,6
Cattle Egret - *Bubulcus ibis*	Waterbird	4	4	BM	w,f	3,5,6
Green Heron - *Butorides virescens*	Waterbird	4		BMW	r,w,f	1,3
Black-crowned Night-Heron - *Nycticorax nycticoras*	Waterbird	3	4	BMW	r,w,f	3,5,6
White-faced Ibis - *Plegadis chihi* **	Waterbird	2	4	B	w	3,5,6
Turkey Vulture - *Cathartes aura*	Landbird	4	4	BM	j,s	1,2,3
Tundra Swan - *Cygnus columbianus*	Waterfowl	NB	NB	BM	w	3,7
Trumpeter Swan - *Cygnus buccinator*	Waterfowl		1	BMW	w	3,7,10
Greater White-fronted Goose - *Anser albifrons*	Waterfowl	NB	NB	M	w	3,7
Snow Goose - *Chen caerulescens*	Waterfowl	NB	NB	M	w	3,7
Ross' Goose - *Chen rossii*	Waterfowl	NB	NB	MW	w	3,7
Canada Goose - *Branta canadensis*	Waterfowl	4	4	BW	r,w	3,7,10
Wood Duck - *Aix sponsa*	Waterfowl	3	3	BW	r,w	3,5
Green-winged Teal - *Anas crecca*	Waterfowl	4	4	BW	w	3,7,10
Mallard - *Anas platyrhynchos*	Waterfowl	4	4	BW	w	3,5,7
Northern Pintail - *Anas acuta*	Waterfowl	3	4	BW	w	3,7,10
Blue-winged Teal - *Anas discors*	Waterfowl	3	4	B	w	3,5,7
Cinnamon Teal - *Anas cyanoptera*	Waterfowl	2	4	BW	w	3,5,7
Northern Shoveler - *Anas clypeata*	Waterfowl	4	4	BW	w	3,7,10
Gadwall - *Anas strepera*	Waterfowl	2	4	BW	w	3,5,7
Eurasian Wigeon - *Anas penelope*	Waterfowl	NB	NB	MW	w	3
American Wigeon - *Anas americana*	Waterfowl	4	4	BW	w	3,7,10
Canvasback - *Aythya valisineria*	Waterfowl	3	3	BMW	w	3,7,10
Redhead - *Aythya americana*	Waterfowl	2	3	BW	w	3,7,10
Ring-necked Duck - *Aythya collaris*	Waterfowl	3	3	BMW	w	3,7,10
Greater Scaup - *Aythya marila*	Waterfowl	NB	NB	MW	w	7,10
Lesser Scaup - *Aythya affinis*	Waterfowl	4	4	BW	w	5,7,10
Harlequin Duck - *Histrionicus histrionicus*	Waterfowl		2	B	r,w	3,5,7
Long-tailed Duck - *Clangula hyemalis*	Waterfowl	NB	NB	MW	w	7
Surf Scoter - *Melanitta perspicillata*	Waterfowl	NB	NB	MW	w	3,7,10

Species:	Initiative	Classification Level: BCR-9	BCR-10	Season(s) of occurrence	Mgmt Issue	Survey Techn.
White-winged Scoter - *Melanitta fusca*	Waterfowl	NB	NB	MW	w	3,7,10
Common Goldeneye - *Bucephala clangula*	Waterfowl		3	BW	r,w	3,5,10
Barrow's Goldeneye - *Bucephala islandica*	Waterfowl		2	BW	r,w	3,5,10
Bufflehead - *Bucephala albeola*	Waterfowl	3	3	BW	r,w	3,5,10
Hooded Merganser - *Lophodytes cucullatus*	Waterfowl		3	BW	r,w,f	3,5
Common Merganser - *Mergus merganser*	Waterfowl	4	3	BW	r,w,f	3,10
Red-breasted Merganser - *Mergus serrator*	Waterfowl	NB	NB	MW	w,f	3,10
Ruddy Duck - *Oxyura jamaicensis*	Waterfowl	2	3	BW	w	3,5,7
Osprey - *Pandion haliaetus*	Landbird	3	4	B	r,w,f	1,2,4,5
Bald Eagle - *Haliaeetus leucocephalus*	Landbird	1	1	BW	r,w,f	2,4,5,10
Northern Harrier - *Circus cyaneus*	Landbird	2	3	BW	r,s,w	1,2,4,5
Sharp-shinned Hawk - *Accipiter striatus*	Landbird	3	3	BW	a,r	1,2,4,5,10
Cooper's Hawk - *Accipiter cooperii*	Landbird	3	3	BW	a,r	2,4,5,10
Northern Goshawk - *Accipiter gentilis*	Landbird	2	2	BW	a,r	2,4,5,10
Broad-winged Hawk - *Buteo platypterus* **	Landbird	NB	NB	M		2,4
Swainson's Hawk - *Buteo swainsoni*	Landbird	2	2	B	r,s	1,2,4,5
Red-tailed Hawk - *Buteo jamaicensis*	Landbird	4	4	BW	a,r,s	1,2,4,5
Ferruginous Hawk - *Buteo regalis*	Landbird	1	1	BMW	j,s	2,4,5,10
Rough-legged Hawk - *Buteo lagopus*	Landbird	NB	NB	MW	s	2,4
Golden Eagle - *Aquila chrysaetos*	Landbird	2	3	BW	s	2,4,5,10
American Kestrel - *Falco sparverius*	Landbird	3	3	BW	s	1,2,4,5
Merlin - *Falco columbarius*	Landbird		4	BMW	p,r,s	2,4,5
Peregrine Falcon - *Falco peregrinus*	Landbird	1	1	BMW	s,w	2,4,5,10
Gyrfalcon - *Falco rusticolus*	Landbird	NB	NB	MW		
Prairie Falcon - *Falco mexicanus*	Landbird	1	2	BW	s	2,5,10
Gray Partridge - *Perdix perdix*	Landbird		4	BW	s	1,5,9
Chukar - *Alectoris chukar*	Landbird	2	4	BW	s	5,9
Ring-necked Pheasant - *Phasianus colchicus*	Landbird	4	4	BW	s,w	1,5,9
Spruce Grouse - *Falcipennis canadensis*	Landbird		2	BW		5
Blue Grouse - *Dendragapus obscurus*	Landbird	1	2	BW	a,r	5,9
Ruffed Grouse - *Bonasa umbellus*	Landbird		2	BW	a,r	1,5,9
Greater Sage-Grouse - *Centrocercus urophasianus*	Landbird	1	1	BW	s	5,9
Sharp-tailed Grouse - *Tympanuchus phasianellus*	Landbird	2	3	BW	s	5,9
Wild Turkey - *Meleagris gallopavo*	Landbird		3	BW	p,r	1,5,9
Gambel's Quail - *Callipepla gambelii* *	Landbird	NB		BW	r,s	1,5,9
California Quail - *Callipepla californica*	Landbird	2	3	BW	r,s	1,5,9
Mountain Quail - *Oreortyx pictus*	Landbird	2	2	BW	p,r,s	5,9
Virginia Rail - *Rallus limicola*	Waterbird	3	3	BMW	w	5,8
Sora - *Porzana carolina*	Waterbird	4	4	B	w	1,5,8
American Coot - *Fulica americana*	Waterbird	4	4	BW	w	3,5,10
Sandhill Crane - *Grus canadensis*	Waterbird	3	3	BM	r,w	3,5,7
Black-bellied Plover - *Pluvialis squatarola*	Shorebird	NB	NB	M	w	3
American Golden-Plover - *Pluvialis dominica*	Shorebird	NB	NB	M	w	3
Snowy Plover - *Charadrius alexandrinus*	Shorebird	3	3	BM	w	3,5,10
Semipalmated Plover - *Charadrius semipalmatus*	Shorebird	NB	NB	M	w	3
Killdeer - *Charadrius vociferus*	Shorebird	3	4	BMW	r,w	1,3,5

Species:	Initiative	Classification Level: BCR-9	BCR-10	Season(s) of occurrence	Mgmt Issue	Survey Techn.
Black-necked Stilt - *Himantopus mexicanus* *	Shorebird	2	4	BM	w	3,5,10
American Avocet - *Recurvirostra americana*	Shorebird	3	3	BM	w	3,5,10
Greater Yellowlegs - *Tringa melanoleuca*	Shorebird	NB	NB	MW	w	3
Lesser Yellowlegs - *Tringa flavipes*	Shorebird	NB	NB	MW	w	3
Solitary Sandpiper - *Tringa solitaria*	Shorebird	NB	NB	M	w	3
Willet - *Catoptrophorus semipalmatus*	Shorebird	2	3	BM	w	1,3,5,10
Spotted Sandpiper - *Actitis macularia*	Shorebird	4	3	BM	r,w	3,5,10
Upland Sandpiper - *Bartramia longicauda* **	Shorebird	NB	2	B	w	1,5,10
Whimbrel - *Numenius phaeopus*	Shorebird	NB	NB	M	w	3
Long-billed Curlew - *Numenius americanus*	Shorebird	2	3	B	s,w	1,3,5,10
Marbled Godwit - *Limosa fedoa*	Shorebird	NB	NB	M	w	1,3,10
Sanderling - *Calidris alba*	Shorebird	NB	NB	M	w	3
Semipalmated Sandpiper - *Calidris pusilla*	Shorebird	NB	NB	M	w	3
Western Sandpiper - *Calidris mauri*	Shorebird	NB	NB	M	w	3
Least Sandpiper - *Calidris minutilla*	Shorebird	NB	NB	M	w	3
Baird's Sandpiper - *Calidris bairdii*	Shorebird	NB	NB	M	w	3
Pectoral Sandpiper - *Calidris melanotos*	Shorebird	NB	NB	M	w	3
Dunlin - *Calidris alpina*	Shorebird	NB	NB	M	w	3
Stilt Sandpiper - *Calidris himantopus*	Shorebird	NB	NB	M	w	3
Long-billed Dowitcher - *Limnodromus scolopaceus*	Shorebird	NB	NB	M	w	3
Short-billed Dowitcher - *Limnodromus griseus*	Shorebird	NB	NB	M	w	3
Wilson's Snipe - *Gallinago delicata*	Shorebird	3	4	BMW	w	1,3,5,10
Wilson's Phalarope - *Phalaropus tricolor*	Shorebird	1	1	BM	w	3,10
Red-necked phalarope - *Phalaropus lobatus*	Shorebird	NB	NB	M	w	3
Franklin's Gull - *Larus pipixcan*	Waterbird	3	3	B	w,f	3,5,6
Bonaparte's Gull - *Larus philadelphia*	Waterbird	NB	NB	M	w,f	3
Mew Gull - *Larus canus**	Waterbird	NB	NB	MW	w,f	3
Ring-billed Gull - *Larus delawarens*	Waterbird	4	4	BW	w,f	3,5,6
California Gull - *Larus californicus*	Waterbird	2	3	BMW	w,f	3,5,6
Herring Gull - *Larus argentatus*	Waterbird	NB	NB	MW	w,f	3,6
Thayer's Gull - *Larus thayeri*	Waterbird	NB	NB	MW	w	3
Glaucous-winged Gull - *Larus glaucescens*	Waterbird	NB	NB	MW	w,f	3,6
Glaucous Gull - *Larus hyperboreus*	Waterbird	NB	NB	MW	w,f	3
Sabine's Gull - *Xema sabini*	Waterbird	NB	NB	M	w,f	3
Caspian Tern - *Sterna caspia*	Waterbird	4	4	B	r,w,f	3,5,6
Common Tern - *Sterna hirundo*	Waterbird		4	B	w,f	3,5,6
Arctic Tern - *Sterna paradisaea*	Waterbird	NB	NB	M	w,f	3,6
Forster's Tern - *Sterna forsteri*	Waterbird	3	3	B	w,f	3,6,10
Black Tern - *Chlidonias niger*	Waterbird	2	2	B	w,f	3,6,10
Rock Pigeon - *Columba livia*	Landbird	4	4	BW	s	1,2,5
Band-tailed Pigeon - *Patagioenas fasciata*	Landbird	3	NB	M		1,2,4,5,10
Mourning Dove - *Zenaida macroura*	Landbird	4	4	BW	j,r,s	1,2,4,5,10
Yellow-billed Cuckoo - *Coccyzus americanus* *	Landbird	2	2	B	r	1,2,4,5,10
Barn Owl - *Tyto alba*	Landbird	3	3	BW	r,w	2,4,5,8
Flammulated Owl - *Otus flammeolus*	Landbird	1	1	BM	a,p	4,5,8
Western Screech-Owl - *Megascops kennicottii*	Landbird	3	3	BW	a,r	1,2,5,8

Species:	Initiative	Classification Level: BCR-9	BCR-10	Season(s) of occurrence	Mgmt Issue	Survey Techn.
Great Horned Owl - *Bubo virginianus*	Landbird	4	4	BW	a,p,r	1,2,5,8
Snowy Owl - *Bubo scandiacus*	Landbird	NB	NB	MW		2,4,10
Northern Pygmy-Owl - *Glaucidium gnoma*	Landbird	2	2	BW	a,p,r	1,2,5,8
Burrowing Owl - *Athene cunicularia*	Landbird	3	3	B	s	1,4,5
Barred Owl - *Strix varia*	Landbird	4	4	BW	r	1,2,5,8
Great Gray Owl - *Strix nebulosa*	Landbird		2	BW	r,w	2,5,8,10
Long-eared Owl - *Asio otus*	Landbird	3	3	BW	a,r	2,4,5,8,10
Short-eared Owl - *Asio flammeus*	Landbird	2	3	BW	r,s,w	1,2,4,5,8
Boreal Owl - *Aegolius funereus*	Landbird	NB	2	BW	a	5,8
Northern Saw-whet Owl - *Aegolius acadicus*	Landbird	3	3	BW	r	2,4,5,8
Common Nighthawk - *Chordeiles minor*	Landbird	4	4	B	r,s,w	1,2,4,5,8
Common Poorwill - *Phalaenoptilus nuttallii*	Landbird	3	3	B	j,s	1,5,8
Black Swift - *Cypseloides niger* *	Landbird	1	1	B	r,w	1,5,6,10
Vaux's Swift - *Chaetura vauxi*	Landbird	3	2	B	w	1,2,4,5
White-throated Swift - *Aeronautes saxatalis*	Landbird	3	3	B	r,s,w	1,2,5,6
Black-chinned Hummingbird - *Archilochus alexandri*	Landbird	3	3	BM	r,s	1,2,4,5,10
Anna's Hummingbird - *Calypte anna*	Landbird	3		M		1,2,10
Calliope Hummingbird - *Stellula calliope*	Landbird	1	1	B	r	1,2,4,5,10
Broad-tailed Hummingbird - *Selasphorus platycercus*	Landbird	3	3	B	a,r	1,2,4,5,10
Rufous Hummingbird - *Selasphorus rufus*	Landbird		3	BM	a,p,r	1,2,4,5,10
Belted Kingfisher - *Ceryle alcyon*	Landbird	3	3	BW	r,f	1,2,4,5
Lewis' Woodpecker - *Melanerpes lewis*	Landbird	1	1	BM	r,p	1,2,5
Red-naped Sapsucker - *Sphyrapicus nuchalis*	Landbird	3	1	BM	a,r	1,2,4,5
Williamson's Sapsucker - *Sphyrapicus thyroideus*	Landbird	1	1	BM	a,r	1,2,5
Downy Woodpecker - *Picoides pubescens*	Landbird	4	4	BW	a,p,r	1,2,5
Hairy Woodpecker - *Picoides villosus*	Landbird	3	4	BW	p,r	1,2,5
White-headed Woodpecker - *Picoides albolarvatus*	Landbird	1	1	BW	p,r	1,2,5
American Three-toed Woodpecker - *Picoides dorsalis*	Landbird	2	2	BW		1,2,5
Black-backed Woodpecker - *Picoides arcticus*	Landbird	2	2	BW	p	1,2,5
Northern Flicker - *Colaptes auratus*	Landbird	4	4	BW	a,p,r	1,2,4,5
Pileated Woodpecker - *Dryocopus pileatus*	Landbird	4	4	BW	p	1,2,5
Olive-sided Flycatcher - *Contopus cooperi*	Landbird	2	2	B		1,2,4,5
Western Wood-Pewee - *Contopus sordidulus*	Landbird	3	3	B	a,p,r	1,2,4,5
Willow Flycatcher - *Empidonax traillii*	Landbird	1	3	B	r	1,2,4,5
Least Flycatcher - *Empidonax minimus*	Landbird	4		B		1,2,4,5
Hammond's Flycatcher - *Empidonax hammondii*	Landbird	1	1	B	a	1,2,4,5
Dusky Flycatcher - *Empidonax oberholseri*	Landbird	2	2	B	a,r	1,2,4,5
Gray Flycatcher - *Empidonax wrightii* **	Landbird	2	3	B	j,s	1,2,4,5
Cordilleran Flycatcher - *Empidonax occidentalis*	Landbird	3	3	B	a	1,2,5
Say's Phoebe - *Sayornis saya*	Landbird	3	3	BM	s	1,2,4,5
Ash-throated Flycatcher - *Myiarchus cinerascens* **	Landbird	4	4	B	j,s	1,2,4,5
Western Kingbird - *Tyrannus verticalis*	Landbird	3	4	B	r,s	1,2,4,5
Eastern Kingbird - *Tyrannus tyrannus*	Landbird	4	4	B	r,s	1,2,4,5
Northern Shrike - *Lanius excubitor*	Landbird	NB	NB	MW	j,s	2,4
Loggerhead Shrike - *Lanius ludovicianus*	Landbird	2	2	BMW	j,s	1,2,4,5
Cassin's Vireo - *Vireo cassinii*	Landbird	2	2	BM	p	1,2,4,5

Species:	Initiative	Classification Level: BCR-9	BCR-10	Season(s) of occurrence	Mgmt Issue	Survey Techn.
Plumbeous Vireo - *Vireo plumbeus*	Landbird	3	3	B	j,r	1,2,5
Warbling Vireo - *Vireo gilvus*	Landbird	3	3	B	a,r	1,2,4,5
Red-eyed Vireo - *Vireo olivaceus*	Landbird		3	B	r	1,2,4,5
Gray Jay - *Perisoreus canadensis*	Landbird	4	4	BW		1,2,5
Steller's Jay - *Cyanocitta stelleri*	Landbird	4	4	BW	j,p	1,2,5
Blue Jay - *Cyanocitta cristata*	Landbird	NB	NB	MW		2
Western Scrub-Jay - *Aphelocoma californica***	Landbird	4		BW	j	1,2,5
Pinyon Jay - *Gymnorhinus cyanocephalus* **	Landbird	2	3	BW	j	1,2,5
Clark's Nutcracker - *Nucifraga columbiana*	Landbird	3	2	BW	j,p	1,2,5
Black-billed Magpie - *Pica hudsonia*	Landbird	3	3	BW	j,r,s	1,2,5
American Crow - *Corvus brachyrhynchos*	Landbird	4	4	BW	r	1,2,4,5
Common Raven - *Corvus corax*	Landbird	4	4	BW	p,s	1,2,5
Horned Lark - *Eremophila alpestris*	Landbird	4	4	BW	s	1,2,4,5
Tree Swallow - *Tachycineta bicolor*	Landbird	4	3	B	a,r,w	1,2,3,4,5
Violet-green Swallow - *Tachycineta thalassina*	Landbird	4	4	B	r	1,2,3,4,5
N. Rough-winged Swallow - *Stelgidopteryx serripennis*	Landbird	2	3	B	r,s,w	1,2,4,5
Bank Swallow - *Riparia riparia*	Landbird	4	4	B	r,w	1,2,4,5,6
Cliff Swallow - *Petrochelidon pyrrhonota*	Landbird	4	4	B	r,s	1,2,4,5,6
Barn Swallow - *Hirundo rustica*	Landbird	4	4	B	r,w	1,2,4,5
Black-capped Chickadee - *Poecile atricapillus*	Landbird		4	BW	a,p,r	1,2,5
Mountain Chickadee - *Poecile gambeli*	Landbird	3	2	BW	a,p	1,2,5
Boreal Chickadee - *Poecile hudsonica* *	Landbird	NB	4	BW		5
Chestnut-backed Chickadee - *Poecile rufescens*	Landbird	NB	3	BW	p	1,2,5
Juniper Titmouse - *Baeolophus ridgwayi* **	Landbird	3	3	BW	j	1,2,5
Bushtit - *Psaltriparus minimus* **	Landbird	4	NB	BW	j,r	1,2,5
Red-breasted Nuthatch - *Sitta canadensis*	Landbird	4	2	BW	p	1,2,4,5
White-breasted Nuthatch - *Sitta carolinensis*	Landbird	4	4	BW	p,r	1,2,5
Pygmy Nuthatch - *Sitta pygmaea* *	Landbird	2	2	BW	p	1,2,5
Brown Creeper - *Certhia americana*	Landbird	3	4	BW	p	1,2,4,5
Rock Wren - *Salpinctes obsoletus*	Landbird	2	3	BMW	s	1,3,5
Canyon Wren - *Catherpes mexicanus*	Landbird	3	3	BMW		1,2,5
Bewick's Wren - *Thryomanes bewickii*	Landbird	4	3	BMW	r	1,25
House Wren - *Troglodytes aedon*	Landbird	4	4	BMW	a,r	1,2,4,5
Winter Wren - *Troglodytes troglodytes*	Landbird	4	4	BW	r	1,2,4,5
Marsh Wren - *Cistothorus palustris*	Landbird	2	3	BMW	r	1,2,3,4,5
American Dipper - *Cinclus mexicanus*	Landbird	3	2	BW	r	1,2,5
Golden-crowned Kinglet - *Regulus satrapa*	Landbird	3	3	BW	a,j,r	1,2,4,5
Ruby-crowned Kinglet - *Regulus calendula*	Landbird	3	3	BMW	j,r	1,2,4,5
Blue-gray Gnatcatcher - *Polioptila caerulea* **	Landbird	4	4	B	j,r	1,2,4,5
Western Bluebird - *Sialia mexicana*	Landbird	4	4	BM	j,r	1,2,4,5
Mountain Bluebird - *Sialia currucoides*	Landbird	3	2	BMW	j,r,s	1,2,4,5
Townsend's Solitaire - *Myadestes townsendi*	Landbird	3	2	BW	j	1,2,4,5
Veery - *Catharus fuscescens*	Landbird		3	B	r	1,2,4,5
Swainson's Thrush - *Catharus ustulatus*	Landbird	4	3	B	a,r	1,2,4,5
Hermit Thrush - *Catharus guttatus*	Landbird	4	4	BMW	p	1,2,4,5

Species:	Initiative	Classification Level: BCR-9	BCR-10	Season(s) of occurrence	Mgmt Issue	Survey Techn.
American Robin - *Turdus migratorius*	Landbird	4	4	BW	j,r	1,2,4,5
Varied Thrush - *Ixoreus naevius*	Landbird	NB	3	BW		1,2,4,5
Gray Catbird - *Dumetella carolinensis*	Landbird		4	B	r	1,2,4,5
Northern Mockingbird - *Mimus polyglottos*	Landbird	4	4	B	r,s	1,2,4,5
Sage Thrasher - *Oreoscoptes montanus*	Landbird	2	2	B	s	1,2,4,5
European Starling - *Sturnus vulgaris*	Landbird	4	4	BW	a,r,w	1,2,5
American Pipit - *Anthus rubescens*	Landbird		4	BMW		1,2,4,5
Bohemian Waxwing - *Bombycilla garrulus*	Landbird	NB	4	BMW	r	2,4,5
Cedar Waxwing - *Bombycilla cedrorum*	Landbird	4	4	BW	j,r	1,2,4,5
Orange-crowned Warbler - *Vermivora celata*	Landbird	4	4	BMW	a,r	1,2,4,5
Nashville Warbler - *Vermivora ruficapilla*	Landbird	3	3	BM	p,r	1,2,4,5
Virginia's Warbler - *Vermivora virginiae* **	Landbird	3	1	B	j	1,2,4,5
Yellow Warbler - *Dendroica petechia*	Landbird	4	4	B	r	1,2,4,5
Chestnut-sided Warbler - *Dendroica pensylvanica*	Landbird	NB	NB	M		2,4
Magnolia Warbler - *Dendroica magnolia* **	Landbird	NB	NB	M		2,4
Yellow-rumped Warbler - *Dendroica coronata*	Landbird	4	4	BMW	a,r	1,2,4,5
Black-throated Gry. Warbler - *Dendroica nigrescens* **	Landbird	3	3	B	j	1,2,4,5
Townsend's Warbler - *Dendroica townsendi*	Landbird		2	BM		1,2,4,5
Blackpoll Warbler - *Dendroica striata*	Landbird	NB	NB	M		2,4
Black-and-white Warbler - *Mniotilta varia*	Landbird	NB	NB	M		2,4
American Redstart - *Setophaga ruticilla*	Landbird	4	4	BM	r	1,2,4,5
Ovenbird - *Seiurus aurocapilla*	Landbird	NB	NB	M		2,4
Northern Waterthrush - *Seiurus noveboracensis*	Landbird	NB	4	B	a,r	1,2,4,5
MacGillivray's Warbler - *Oporornis tolmiei*	Landbird	2	2	B	r	1,2,4,5
Common Yellowthroat - *Geothlypis trichas*	Landbird	4	4	B	r,w	1,2,4,5
Wilson's Warbler - *Wilsonia pusilla*	Landbird	3	3	BM	r	1,2,4,5
Yellow-breasted Chat - *Icteria virens*	Landbird	3	3	B	r	1,2,4,5
Western Tanager - *Piranga ludoviciana*	Landbird	3	2	B	a,j,p,r	1,2,4,5
Black-headed Grosbeak - *Pheucticus melanocephalus*	Landbird	3	3	B	r	1,2,4,5
Rose-breasted Grosbeak - *Pheucticus ludovicanus*	Landbird	NB	NB	M		2,4
Blue Grosbeak - *Passerina caerulea* **	Landbird	4	4	B	r	1,2,4,5
Lazuli Bunting - *Passerina amoena*	Landbird	2	2	B	j,r	1,2,4,5
Indigo Bunting - *Passerina cyanea*	Landbird	NB	NB	M	r	2,4
Green-tailed Towhee - *Pipilo chlorurus*	Landbird	3	2	B	j	1,2,4,5
Spotted Towhee - *Pipilo maculatus*	Landbird	4	3	BMW	r	1,2,4,5
American Tree Sparrow - *Spizella arborea*	Landbird	NB	NB	MW		2,4
Chipping Sparrow - *Spizella passerina*	Landbird	4	3	BM	j,r,s	1,2,4,5
Brewer's Sparrow - *Spizella breweri*	Landbird	1	2	B	j,s	1,2,4,5
Vesper Sparrow - *Pooecetes gramineus*	Landbird	4	4	B	s	1,2,4,5
Lark Sparrow - *Chondestes grammacus*	Landbird	3	3	BM	j,s	1,2,5
Black-throated Sparrow - *Amphispiza bilineata* **	Landbird	2	3	B	j,s	1,4,5
Sage Sparrow - *Amphispiza belli* **	Landbird	2	2	B	s	1,4,5
Lark Bunting - *Calamospiza melanocorys*	Landbird		2	BM	s	1,2,5
Savannah Sparrow - *Passerculus sandwichensis*	Landbird	4	4	BM	r,w	1,2,4,5
Grasshopper Sparrow - *Ammodramus savannarum*	Landbird	3	3	B		1,4,5
Fox Sparrow - *Passerella iliaca*	Landbird	4	4	BM	r	1,2,4,5

Species:	Initiative	Classification Level: BCR-9	BCR-10	Season(s) of occurrence	Mgmt Issue	Survey Techn.
Song Sparrow - *Melospiza melodia*	Landbird	4	4	BW	r,w	1,2,4,5
Lincoln's Sparrow - *Melospiza lincolnii*	Landbird	4	4	BMW	r	1,2,4,5
Swamp Sparrow - *Melospiza georgiana*	Landbird	NB	NB	MW	r,w	2,4
White-throated Sparrow - *Zonotrichia albicollis*	Landbird	NB	NB	MW		2,4
Golden-crowned Sparrow - *Zonotrichia atricapilla*	Landbird	NB	NB	MW	r	2,4
White-crowned Sparrow - *Zonotrichia leucophrys*	Landbird	4	4	BW	r	1,2,4,5
Harris' Sparrow - *Zonotrichia querula*	Landbird	NB	NB	MW		2,4
Dark-eyed Junco - *Junco hyemalis*	Landbird	4	4	BW	j,r	1,2,4,5
Lapland Longspur - *Calcarius lapponicus*	Landbird	NB	NB	MW	w	2,4
Snow Bunting - *Plectrophenax nivalis*	Landbird	NB	NB	MW		2,4
Bobolink - *Dolichonyx oryzivorus*	Landbird	3	3	B		1,2,4,5
Red-winged Blackbird - *Agelaius phoeniceus*	Landbird	4	4	BMW	r,w	1,2,4,5
Western Meadowlark - *Sturnella neglecta*	Landbird	4	4	BMW	s	1,2,4,5
Yellow-hd. Blackbird - *Xanthocephalus xanthocephalus*	Landbird	3	3	BMW	w	1,2,4,5
Brewer's Blackbird - *Euphagus cyanocephalus*	Landbird	2	4	BW	r,s,w	1,2,4,5
Great-tailed Grackle - *Quiscalus mexicanus* **	Landbird	4	NB	BW	r	1,2,4,5
Common Grackle - *Quiscalus quiscula*	Landbird		4	BMW	r	1,2,4,5
Brown-headed Cowbird - *Molothrus ater*	Landbird	4	4	BMW	r,s,w	1,2,4,5
Bullock's Oriole - *Icterus bullockii*	Landbird	3	3	B	r	1,2,4,5
Scott's Oriole - *Icterus parisorum*	Landbird	3	3	B	j,r	1,2,4,5
Black Rosy-Finch - *Leucosticte atrata*	Landbird		1	BW		2,4,5,10
Gray-crowned Rosy-Finch - *Leucosticte tephrocotis*	Landbird	3	3	BMW		2,4,5,10
Pine Grosbeak - *Pinicola enucleator*	Landbird	4	4	BW		1,2,4,5
Cassin's Finch - *Carpodacus cassinii*	Landbird	3	1	BW		1,2,4,5
House Finch - *Carpodacus mexicanus*	Landbird	4	4	BW	p,r	1,2,4,5
Red Crossbill - *Loxia curvirostra*	Landbird	4	2	BW		1,2,5
White-winged Crossbill - *Loxia leucoptera*	Landbird	NB	4	BMW		1,2,5
Common Redpoll - *Carduelis flammea*	Landbird	NB	NB	MW		2,4
Pine Siskin - *Carduelis pinus*	Landbird	4	4	BW	j,p	1,2,4,5
Lesser Goldfinch -*Carduelis psaltria* **	Landbird	4	NB	B	r	1,4,5
American Goldfinch - *Carduelis tristis*	Landbird	4	4	BW	r	1,2,4,5
Evening Grosbeak - *Coccothraustes vespertinus*	Landbird	3	3	BMW		1,2,4,5
House Sparrow - *Passer domesticus*	Landbird	4	4	BW	r	1,2,5

***** occurs only in BMR-50
** occurs only in BMR-51

Appendix B. Sample Size Estimation Procedure for Products of IBIS and Coordinated Bird Monitoring

This Appendix presents sample size formulas for regional models, site-based models, and project evaluations.

Regional and Site-based Models

Standard regression (or other) methods are used to construct the models. Mixed effects models (e.g., Agresti 2002) are often needed to acknowledge stratification, multi-stage sampling (e.g., surveying clusters of points), or both. The three most common predictions, and their measures of accuracy, are (a) estimated region-wide total or mean, (b) estimated parameter value for a single site that has not been surveyed, typically because the habitat of interest is part of a proposed project and does not yet exist on the ground, and (c) estimated change in parameter value with each unit increase in one of the independent variables. *CV*s provide useful measures of accuracy for all three estimates. As an example of the third estimate, suppose that a model predicted abundance/ha, y, as $y = b_o + 0.5$(stand size in ha) + (other terms). The equation predicts that the average number of birds per ha increases by 0.5 for each 1-ha increase in stand size (if other variables do not change). If the *CV* for the coefficient (0.5) was 0.25, it would mean that the 95% *CI* for the increase was ±50% of the coefficient or (0.25, 0.75).

Pilot study data are needed for reliable estimation of the sample sizes needed to construct regression models but the following approach may be of some use for planning. In estimating a regional mean we hope that the regression model will improve precision compared to the simple mean. But performance of the regression model cannot be worse than the simple mean, so we might estimate sample sizes for the simple mean as a conservative initial estimate. With simple random sampling, the sample size for any desired $CV(\bar{y})$ may be expressed as

$$n = \left(\frac{CV(y_i)}{CV(\bar{y})} \right)^2$$

where y_i is the mean from the i^{th} primary unit (e.g., transect or point). Table B1 gives some typical values. For example, if the desired $CV(\bar{y})$ is 0.20 (95% CI ≈ mean ±40% of the mean) and $CV(y_i) = 2$, then the needed sample size is 100.

Table B1. Sample size for estimating a mean expressed.

Desired $CV(\bar{y})$	$CV(y_i)$			
	1	1.5	2	2.5
0.15	44	100	178	278
0.20	25	56	100	156
0.25	16	36	64	100
0.30	11	25	44	69

An advance estimate of the sample size needed to achieve a specified *CV* for the regression coefficient can also obtained if we can estimate the correlation coefficient between the independent and dependent variables or, perhaps more reasonably, if we assume that variables are only interesting if they have a fairly high correlation with the dependent variable. Table B2 gives some values. For example, suppose (a) we are trying to predict abundance, (b) the desired *CV* of the regression coefficient, b_k, is 0.15, and (c) we are mainly interested in independent variables whose correlation with abundance is at least 0.6 (on the basis that variables with lower correlations have little capacity for helping us predict abundance or understand what determines it). In this case, from Table B2, the needed sample size is 81. These analyses suggest that a sample size of 100 points seems reasonable for initial efforts to develop

regression models that can be used to estimate regional means or help elucidate factors correlated with the parameter (e.g., abundance, a fitness indicator).

Table B2. Sample size for estimating regression coefficients, b_k.

Desired CV(b_k)	Correlation coefficient of x_k and y_k				
	0.4	0.5	0.6	0.8	0.9
0.10	527	302	180	58	25
0.15	235	135	81	27	12
0.20	133	77	46	16	8
0.25	86	50	30	11	6

Accuracy targets for these estimates also may be expressed using the *CV*. A *CV* of 0.25, for example, means that the 95% confidence interval (CI) is approximately the mean ±50% of the mean. Thus, if the estimate was 50 and the *CV* was 0.25, then the 95% CI would be approximately (25, 75).

Project Evaluations

Project evaluations involve surveys on a project site before, during, and after the project. These surveys help evaluate and perhaps revise the project and they document effects of the project on birds.

Sample sizes required in project evaluations to detect a given change, *R*, may be estimated if an estimate of the *CV* of the measurements is available from a pilot study or from surveys in other areas. The procedure should be based on results per "primary sampling units". If clusters of points are surveyed, then the cluster is the primary sampling unit. If points are evenly (or randomly) distributed across a study area, then the individual point is the primary unit. The sample size also depends on the level of significance, the change expected or that we wish to detect, and the probability (power) we wish to have of detecting the change (i.e., of obtaining a significant result in a statistical test). The change, *R*, is defined as (larger value)/(smaller value) and is thus always >1. A two-step procedure is given here. First, choose the level of significance and power and read the corresponding value of "*G*" in Table B3. Then read the sample size from Table B4. For example, suppose the level of significance will be 0.05 and the desired power is 80% power. *G*, from Table B3, is 16. Suppose further that points are going to be evenly distributed across a study area, the *CV* ($SD(y_i)/\bar{y}$) of numbers recorded per point (or mean numbers if >1 survey is made) is 1.5, and the change of interest is a three-fold increase (*R*=3). The needed sample size, in each period is approximately 76. Conducting the surveys in >1 year is often worthwhile. If surveys were made in three years before the project and in three years after it, then about 25 points should be surveyed per year (in new locations each year).

Table B3. Values of *G*, used in Table B4 to obtain sample sizes.

Level of significance	Power		
	0.6	0.8	0.9
0.05	10	16	21
0.10	7	12	17
0.15	6	10	15

Table B4. Sample sizes as a function of the *G* (from Table B3), the estimated *CV*(y_i), and the change of interest, *R*.

		R		
G	*CV*	1.5	2	3
5	0.5	11	5	3
5	1.0	45	20	11
5	1.5	101	45	25
5	2.0	180	80	45
10	0.5	23	10	6
10	1.0	90	40	23
10	1.5	203	90	51
10	2.0	360	160	90
15	0.5	34	15	8
15	1.0	135	60	34
15	1.5	304	135	76
15	2.0	540	240	135
20	0.5	45	20	11
20	1.0	180	80	45
20	1.5	405	180	101
20	2.0	720	320	180